SCIENTIFIC AMERICAN

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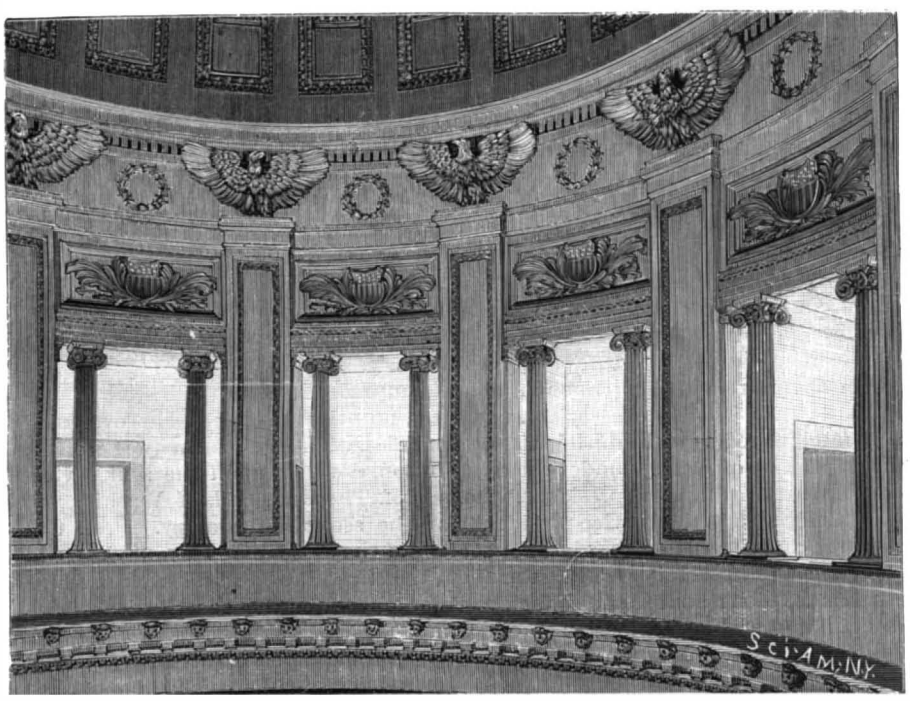
A WEEKLY JOURNAL OF PRACTICAL INFORMATION ART, SCIENCE MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXVI.—No. 18. ESTABLISHED 1845. NEW YORK, MAY 1, 1897. [$3.00 A YEAR. WEEKLY.



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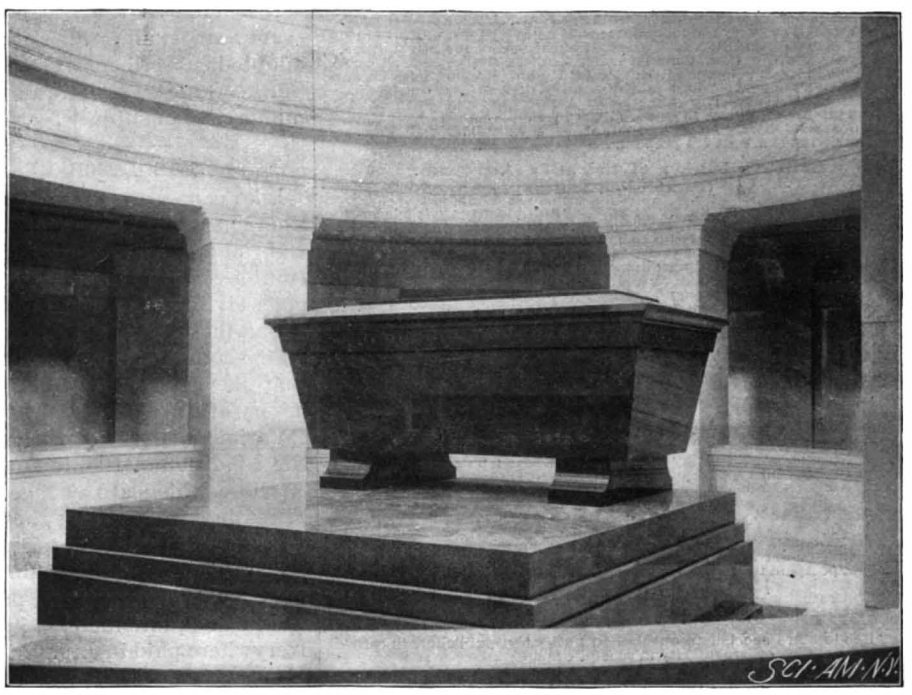

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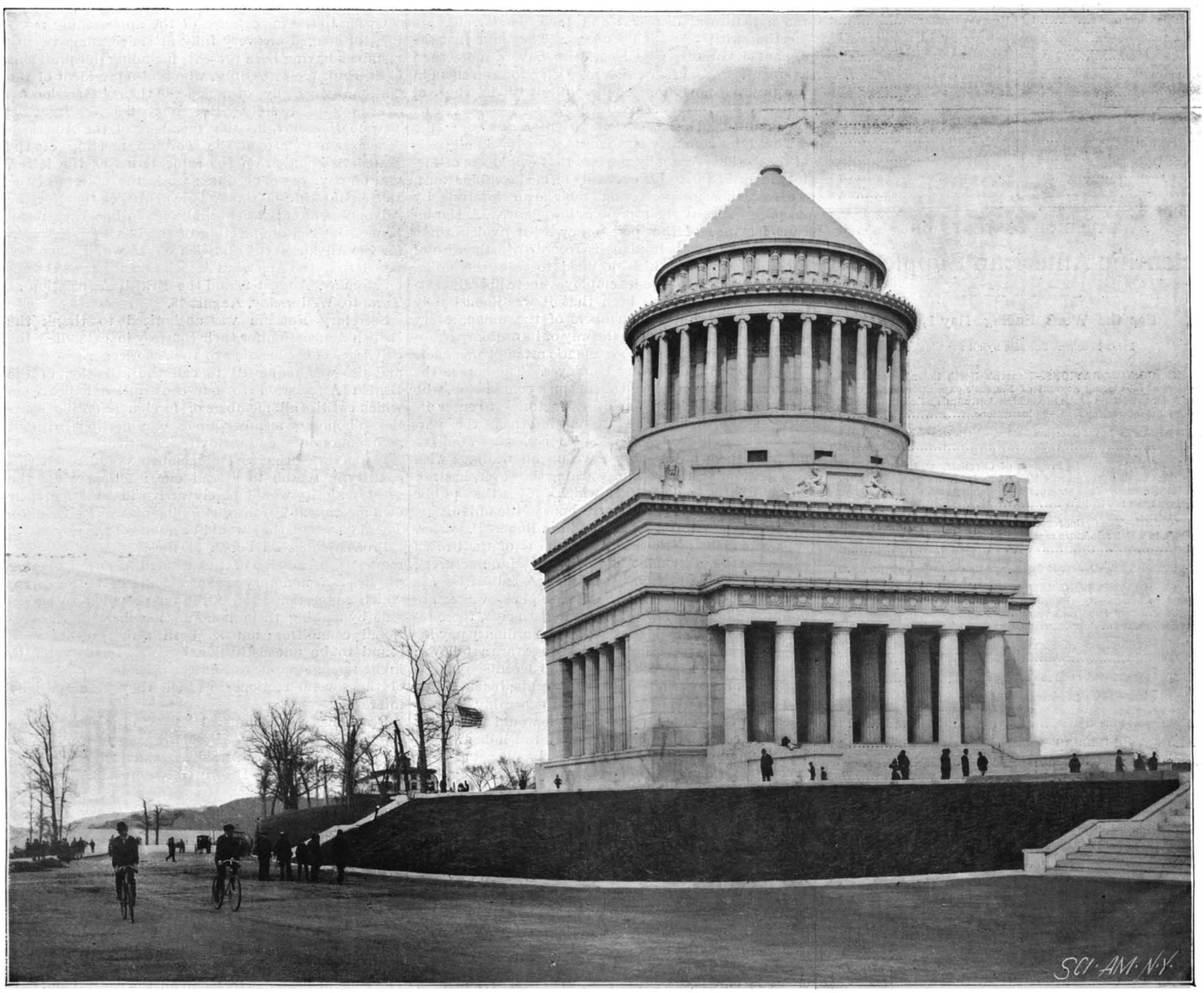

THE GRANT MEMORIAL TOMB, RIVERSIDE PARK, NEW YORK.—[See page 279.]

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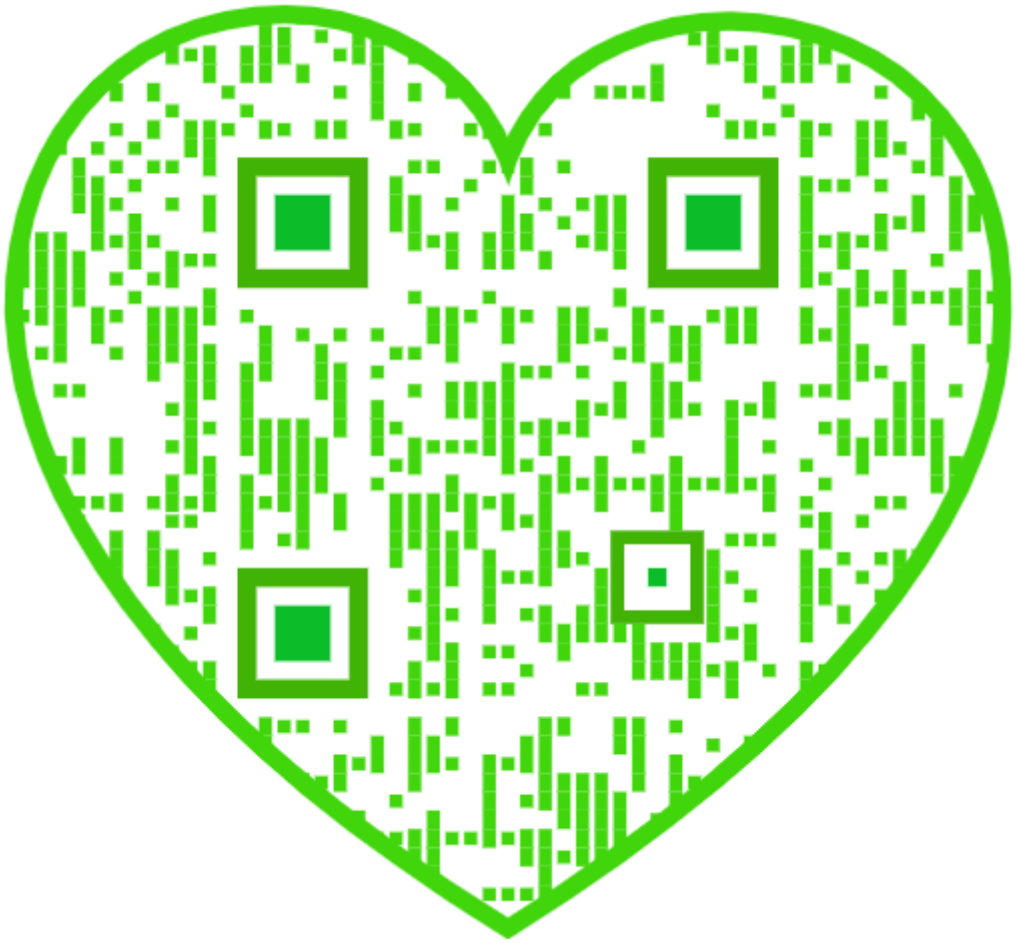

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

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(Established 1845.)

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MUNN & CO., Publishers, 361 Broadway, New York.

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NEW YORK, SATURDAY, MAY 1, 1897.

Contents.

(Illustrated articles are marked with an asterisk.)

Acquisition, our new	274	Heavens for May	275
Amer. Assn. Adv. Sci	274	Hens, Chinese, busy	277
Armor, nickel steel*	280	Industry, animal, United States	279
Automobile, largest	280	Inventions recently patented	283
Bats and music	275	Labor question in Japan	274
Books, new	284	Lamp, electric, new*	276
Building in New York	276	Latitude, variation	275
Camera, chronophotographic*	281	Lawn ornamentation	281
Canal of Joseph	278	Mayflower, log of	276
Cannon, army, large shipment*	280	Metal floating on water	279
Carriage, pneumatic mortar	282	National Academy of Sciences	282
Carriages, horseless, at Brussels	275	Notes and queries	284
Casing, window shade, Kraemer's*	276	Photography, ribbon*	281
Eggs of pearly nautilus	278	Rays, internal	277
Engine, steam, Blanchard's*	283	Research, "useless," value	278
Filter, rain water, Long's*	276	Science notes	278
Floors, hardwood, cleaning	275	Sheets, aluminum coated	278
Fuel, artificial	282	Square, steel, antiquity	283
Grip, cable car, slow speed*	282	Support, thill, Bartlett's*	278
Heaters, electric, Niagara Falls*	277	Tomb, Grant memorial*	273, 279

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1113.

For the Week Ending May 1, 1897.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARCTIC EXPLORATIONS.—Nansen's North Polar Expedition.—A most interesting account of Nansen's expedition, giving detailed illustrations of the life in high latitudes and on the Fram.—A most interesting map.—8 illustrations 17784

II. AUTOCARS.—Loyal Gasoline Motor.—A tricycle motor.—1 illustration 17794

III. CHEMISTRY.—On the Progress of Chemistry and the Chemical Arts During the Queen's Reign.—By Prof. THORPE.—An important resume of the progress in chemistry and chemical technology from 1837 to date 17787

IV. CYCLING.—The Cyclodrome.—A curious device for training purposes, in which miniature races are used as indicators.—1 illustration 17794

V. ELECTRICITY.—Danger to Submarine Cables in Case of War 17798

VI. LOCOMOTIVE ENGINEERING.—The Evolution of the American Locomotive.—By HERBERT T. WALKER.—The second installment of a very important paper, illustrating historical locomotives by means of clear drawings of great fidelity.—8 illustrations. 17790

VII. MATHEMATICS.—The Figure Genius Jacques Inaudi.—1 illustration 17787

VIII. MEDICINE.—Beer and the Kidneys 17798

IX. MILLING.—Recent Improvements in Flour Milling.—A description of an apparatus for mechanically eliminating impurities from grain.—1 illustration 17795

X. MINING ENGINEERING.—Mining and Miners 17792

XI. MISCELLANEOUS.—A New Life Saving Apparatus.—A new life buoy.—1 illustration 17793
Selected Formulæ 17788
Engineering Notes 17789
Electrical Notes 17789
Miscellaneous Notes 17789

XII. NATURAL HISTORY.—The Sloth.—1 illustration 17786

XIII. ORDNANCE.—A New Sectional Gun.—3 illustrations 17793

XIV. PHOTOGRAPHY.—Combined Toning and Fixing Bath 17788
Photographing Flying Bullets 17794
Paste and Glue for Mounting Photographs 17797

XV. TECHNOLOGY.—An English Match Factory.—By JAMES CASSIDY.—A description of the manufacture of matches; the literature upon the subject is extremely limited 17796
Letang & Serpollet's Acetylene Lamp.—A description of the new portable lamp, which generates within itself acetylene gas for its consumption.—1 illustration 17795
Paste and Glue.—Thirteen valuable formulas 17797

OUR NEW ACQUISITION.

We take much pleasure in announcing that we have concluded negotiations with the proprietors of the Progress of the World, the publication of which has been discontinued with the March issue, as the result of which that well known and highly creditable journal will henceforth be absorbed by the SCIENTIFIC AMERICAN, and the subscribers to the Progress of the World will receive the SCIENTIFIC AMERICAN for a period equivalent to the balance of the subscriptions still due them.

The Progress of the World was a monthly illustrated magazine, summarizing in entertaining description the leading current events in the progress of human achievements and general history, and it has made no promises which it has not amply fulfilled.

Inasmuch as the Progress of the World worked on somewhat similar lines to this journal, our newly adopted subscribers will find in the weekly pages of the SCIENTIFIC AMERICAN an enlarged treatment of a familiar class of subjects.

THE LABOR QUESTION IN JAPAN.

Like causes are producing like results in Japan, and the remarkable industrial development of the country is bringing in its train those very same industrial troubles which have harassed or are still perplexing the older civilizations of the West. If recent labor troubles are an indication, it looks as though the apparent prosperity of Japan was not as healthy as it might be, and that it was based very largely on the poverty and misery of the wage earners.

Various writers upon Japan have familiarized us with the condition of the Japanese lower classes, especially of those which are engaged in agricultural pursuits. These descriptions have shown that though the peasant is poor, he has few wants and less cares, and lives a free and happy life. The coming of the mill and the factory has brought confinement, monotonous toil, long hours, and no adequate increase in the pitiful wages which are everywhere paid in Japan. The toilers have felt all the burdens of an industrial age without its rewards, and the result has been that the factory owners are having great difficulty in securing operatives to keep their machinery going on full time. So serious has the question become that recruiting agents are being sent out into the agricultural districts; and these, be it said, are meeting with very slight success. They find that the Japanese parents, who as a class have a more than average love for their children, prefer to keep them in the positive poverty of country life, with its cheerful and healthy surroundings, rather than let them go to the doubtful advantages of factory life.

That human nature is a constant factor in all parts of the world is shown by the fact that employers of factory labor in Japan have already formed combinations, with a view to protecting their own interests by keeping wages at their present low figure. A significant instance of the persistency with which these unions carry out their plans is recorded in the case of a certain factory which declined to join the union and endeavored to give its employes more liberal treatment. The result has been that it was immediately boycotted by all the members of the union, every obstruction was thrown in the way of its ordinary transaction of business, and a systematic attempt was made to prevent its obtaining employes. Thereupon the progressive firm employed agents on a commission, who were to induce girls from other factories to enter its service. Forthwith the union informed the purchasers of their own goods that no more sales would be made to them unless they gave up all dealings with this particular firm. The warning, however, has not affected their trade—a fact which proves that public sentiment is opposed to the methods of the union.

According to the report made by Mr. Robert P. Porter, superintendent of the eleventh census of the United States, to the National Association of Manufacturers, the wages paid in the various Japanese industries are invariably low. It seems that the highest wages are paid to tailors who make European garments, these receiving 24·6 cents (gold) per day. The ordinary pay for tailors is 14·2 cents per day. Other wages are as follows: Stonecutters, 18·2 cents; printers, 13 3 cents; typesetters, 14 cents; porcelain makers, 14·9 cents; blacksmiths, 15·5 cents; and dyers receive 12·7 cents per day.

These wages were low enough, one would think; but when we come to study the agricultural industry, the case is more pitiful yet. Male farm hands get at most 9·5 cents per day; female farm hands, 6 cents; and day laborers, 11 cents. These, we are told, are maximum figures! The minimum figures are from 2½ to 7 cents a day less, female farm hands sometimes receiving only 3·5 cents per day; female silk growers, 4·4 cents; day laborers, 7·3 cents; printers, 7·7 cents; and typesetters, 7·6 cents.

With these wages prevailing in the labor market, it is easily understood how Japan can compete successfully with the older countries in the production of certain manufactured products, and that she can do so is shown by the fact that the value of its exports increased from $15,553,472, in 1868, to $136,112,177 in 1895.

The low wages of Japanese labor and the rapid increase in her industries have led the manufacturers of other countries to fear that they could not hold their own in competition, and to regard a Japanese control of certain markets as inevitable. We think, however, that the danger is very remote, for the reason that the very labor troubles of which we have spoken above will act as a controlling and leveling influence, by bringing about an increase in the pay of the Japanese workman. The higher wages of the artisan will cause him to acquire more expensive tastes than he had in his country life, and with this will come new ideas of his own rightful share in the profits of the manufactured article. The competition among employers to secure labor will also favor a rise in the scale of wages; and as even the ingenuity of the Japanese people cannot hope to compensate for this by proportionate improvements in machinery and methods of manufacture, it is certain that the total cost of manufacture must in the future increase in Japan.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SPECIAL MEETING OF THE COUNCIL.

BY WILLIAM H. HALE.

An important meeting of the Council of the American Association for the Advancement of Science was held on April 21 at the Smithsonian Institution, at Washington, pursuant to a call by the late president, Prof. E. D. Cope, dated March 31, only twelve days before his death.

Such an event is unprecedented in the history of the association; in fact, no other president has ever died during his term of office. The succession to the office, under the constitution, devolves upon the senior vice-president, who is Prof. Theodore Gill, of Washington, vice-president for the section of zoology. Prof. Gill has been a member of the association since 1868.

The permanent secretary, Prof. F. W. Putnam, called the council to order and stated the constitutional provision under which Prof. Gill was authorized to preside. The latter then took the chair. As it appeared that the president just deceased had not prepared his annual message for the approaching Detroit meeting, a vote of the council was passed, requesting Prof. Gill to deliver the annual address, in the form of an obituary of President Cope, which he undertook to do.

Owing to the importance of the approaching meeting, the council was very fully attended, some twenty members having been present, including the president elect, Prof. Wolcott Gibbs, who is also president of the National Academy of Sciences, then in session at Washington. Secretary Putnam read letters from Sir Vernon Harcourt, inviting members of the American Association to attend the Toronto meeting of the British Association on the same terms as the latter, viz., on payment of $5 dues; while the officers of the Detroit meeting of the American Association for the Advancement of Science will be made honorary members of the Toronto meeting of the British Association for the Advancement of Science. It will be remembered that the American Association meets at Detroit on Monday, August 9, and the British Association at Toronto, Wednesday, August 18.

Secretary Putnam was authorized to thank the British Association for their courtesy in extending the privileges of the meeting to the American Association, and also was requested to call the attention of the British Association to our constitutional provision which entitles all members of foreign scientific societies to honorary membership at our meetings without payment of dues, and to invite them to attend.

It was stated that several members would reach this country in season to attend our meeting, while the great majority would barely arrive in time for their own meeting at Toronto, stopping over at Montreal on Tuesday, where they would be guests of the city.

Prof. Nichols, on behalf of the section of physics, requested permission of the council to enroll visiting physicists as honorary vice-presidents of that section, which suggestion Prof. Atkinson proposed to supersede by making them honorary members of the sectional committee; but as both arrangements were found to be unconstitutional, it was finally voted to invite foreign guests to register as honorary members of the several sections in which they were specially interested.

Death has made unusual havoc in the council since the meeting at Buffalo. Besides President Cope, B. A. Gould, one of the past presidents, and an auditor of the association, and G. Brown Goode, president-elect of the section of zoology, have passed away. S. C. Chandler was elected auditor and L. O. Howard was nominated as president of the zoological section, to be elected at the general session of the association at Detroit. Ten persons were elected to membership.

Secretary Putnam, who has recently visited Detroit, reported extremely satisfactory progress in arrangements for the meeting; the facilities for physical comfort and convenience surpassing those of any preceding meeting. The hotel headquarters will be at the large new hotel, the Cadillac, with reduced rates to members. The general headquarters, and all the general and sectional meetings and lectures, will be at the fine new

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high school, which has section rooms sufficiently numerous to accommodate two dozen sections if required, instead of the nine sections actually existing. There is also a large hall, capable of seating 2,500 persons, in which Prof. Putnam lectured during his visit to the city.

Prof. Putnam made the suggestion to the local committee that the usual excursion shall this year take the form of a trip by lake after the close of the meeting, leaving Detroit on Saturday morning for Buffalo and Niagara Falls, and reaching Toronto on the day before the meeting of the British Association—an arrangement which will probably be made, though one member of the council suggested instead a trip to the Sault Ste. Marie with return to Toronto via Canadian Railway.

THE HEAVENS FOR MAY.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

The sun's right ascension on May 1 is 2 h. 36 m. 27 s., and its declination north 15 deg. 18 m. 24 s.

On the last day of the month its right ascension is 4 h. 35 m. 19 s., and its declination north 22 deg. 1 m. 38 s.

MERCURY.

Mercury is evening star during the early part of the month. Having passed its greatest elongation east on April 28, it may be picked up during the first week of May in the western sky, just as soon as it is dusk. On May 21 it comes into inferior conjunction with the sun, or on a line between the earth and the sun, and changes from evening to morning star.

On May 10 Mercury is apparently stationary. On May 16, at ten o'clock, it is at the place of its ascending node, and on May 26 it is in aphelion.

On May 3, at 11 h. 26 m., Mercury is in conjunction with the moon, when Mercury will be 2 deg. 6 m. south of the moon.

It will be again in conjunction with the moon on May 30, at 7 h. 2 m., when Mercury will be 8 deg. 27 m. south of the moon.

VENUS.

Venus, after its long and splendid reign as evening star, came into inferior conjunction with the sun on April 28, and is now morning star. Very rapidly will it sweep outward from the sun's blinding rays, and after the middle of May will be a glorious object in the eastern morning sky.

On May 17 Venus is apparently stationary, that is, its orbital motion is in the line of sight, and at this time away from the earth. On May 21 it is at its descending node.

On May 1, at 6 h. 20 m., Venus is in conjunction with the moon. This is quite a close conjunction, Venus being only 22 minutes of arc south of the moon. Venus is again in conjunction with the moon on May 28, at 6 h. 6 m., when Venus will be 6 deg. 32 m. south of the moon.

On the first of the month, Venus, having just passed inferior conjunction, rises only a few minutes before the sun, and reaches the meridian at 11 h. 30 m. A. M. On the last of the month it rises at 2 h. 50 m.; and crosses the meridian at 9 h. 25 m. A. M.

The right ascension of Venus at the middle of the month is 1 h. 52 m. 47 s.; and its declination north 12 deg. 45 m. 40 s.

MARS.

Mars is evening star, well up in the western sky at dusk, but at such a great distance from the earth as to rob it of much of its interest as a telescopic object. It is well, however, to be able to identify it among the starry hosts. Mars is on the border line between Cancer and Gemini, and moving slowly into the first named constellation.

On May 25, at 7 A. M., there will be a very close conjunction of Mars and the star Eta in Cancer.

While the exact conjunction may not be seen, the two objects will be very near to each other on the evenings preceding and following the conjunction.

On May 21 Mars is in aphelion.

On May 7, at 4 h. 35 m. in the afternoon, Mars will be in conjunction with the moon, when Mars will be only 22 minutes of arc north of the moon—a distance ten minutes of arc less than the moon's diameter.

On the first of the month Mars crosses the meridian 4 h. 50 m. P. M., and sets about 20 minutes after midnight. On the last of the month it crosses the meridian at 4 h. P. M. and sets at a quarter past eleven.

The right ascension of Mars on the fifteenth of the month is 8 h. 3 m. 7 s.; and its declination north 22 deg. 6 m. 14 s.

JUPITER.

Jupiter is evening star, and in excellent position for observation in the early evening hours. Good telescopic work can be done on Jupiter in bright twilight, the belts often showing with wonderful distinctness at such a time.

Jupiter is apparently almost stationary two degrees east of Regulus, in the constellation Leo, during the first half of May.

On May 21 Jupiter is in quadrature with the sun, or ninety degrees east thereof.

On May 10 Jupiter is in conjunction with the moon, at 2 h. 42 m. P. M., when Jupiter will be 3 deg. 20 m. north of the moon.

The following are some of the interesting phenomena of the satellites:

On the evening of May 4, at 10 h. 26 m., the I satellite will enter upon the disk of the planet in transit. At 11 h. 39 m. the shadow of satellite I will ingress. At 12 h. 45 m. the satellite I will pass off the disk. On May 9, at 8 h. 21 m. P. M., satellite II will disappear in occultation.

On the evening of May 12, at 7 h. 45 m., the shadow of satellite III will enter in transit. At 9 h. 27 m. the I satellite will disappear in occultation. At 11 h. 33 m. the shadow of satellite III will leave the disk.

On May 20, at 8 h. 41 m. P. M., satellite I will enter in transit. At 9 h. 58 m. the shadow of satellite I will enter in transit. At 11 h. 0 m. satellite I will pass off the disk, and at 12 h. 17 m. the shadow of satellite I will egress.

On the first of the month Jupiter is on the meridian at 7 h. 30 m. P. M., and sets at 2 h. 18 m. A. M.

On the last of the month it crosses the meridian at 5 h. 39 m. P. M., and sets about 20 minutes after midnight.

The right ascension of Jupiter on May 15 is 10 h. 13 m. 10 s. and its declination north 12 deg. 19 m. 6 s.

SATURN.

Saturn is morning star during the first half of the month, but comes into opposition with the sun on May 17, when it changes to evening star. It is in conjunction with the moon on May 16 at 1 h. 54 m., when Saturn will be 7 deg. 11 m. north of the moon.

Saturn rises on the 1st of the month at 8 h. 10 m. P. M. On the last of the month it is on the meridian at 11 P. M. and sets at 4 A. M.

URANUS AND NEPTUNE.

Uranus comes into opposition with the sun on May 17, at 1 o'clock, only 11 hours previous to Saturn. It rises then at sunset, and its place in the heavens for that date is right ascension, 15 h. 39 m. 7 s.; declination south, 19 deg. 16 m. 39 s. It is in the head of Scorpio.

Neptune is low down in the western evening sky, and too near the sun for observation.

Smith Observatory, Geneva, N. Y., April 19, 1897.

ON THE VARIATION OF LATITUDE.*

BY S. C. CHANDLER.

At the autumn meeting of the National Academy in 1894, which was the last occasion upon which I asked for its attention to this subject, I presented the numerical theory of the motion of the pole synthetically derived from the observations from the beginning of the history of the astronomy of precision up to that time, in its complete development, exactly as it stands to-day. Since then I have been interested to compare it with the various series of observations, as they have been published from time to time, not only for the purpose of verification or improvement of the numerical values of the various constants, but also to detect any additional characteristics which these later data might make apparent. These additional investigations have individually been neither extensive nor important enough to call for separate publication, since their general result has been nearly a satisfactory confirmation of the previous deductions as to the nature of the laws of these motions, without furnishing material improvement of the numerical elements. But sufficient material has thus been gradually accumulating to make the present communication of some interest.

The new material to be here utilized consists of the various series of observations by Tallcott's method up to the middle of 1896, as far as published, at the following European stations, named in order of longitude: Kasan, Vienna, Prague, Berlin, Potsdam, Carlsruhe and Strasburg. In America we have Doolittle's series at Bethlehem, which was brought to an end in the summer of 1895. He is now carrying forward a new series at Philadelphia, of which we may hope soon to see the results. Of the series at Columbia University, by Rees, Jacoby and Davis, begun in the spring of 1893 and still current, there have come into my hands within a few days the results for the first fourteen months, so that I have assumed the privilege of incorporating them in this investigation.

The curves of latitude variation from these various series are here shown (exhibiting several charts) and compared with the known numerical theory. This shows a concordance and fidelity of representation which is in every way satisfactory, the difference between computation and observation being practically within the range of the uncertainty of errors of observation.

A determination of the elements of the ellipse of the annual component of the polar motion was then presented, made from the new observations independently of the older ones previously used. The resulting elements are practically identical, as to form, size and position. This seems to show that the axis of this elongated vibratory motion is stationary on the earth's surface along a meridian of forty-five degrees east of Greenwich. This negative evidence as to any apsidal motion seems to be of extreme importance in its bearing on the theory of the earth's rotation.

A demonstration was then presented of the fact that since 1890 the circular 428-day motion has been diminishing its radius, in conformity to the requirements of the numerical theory derived from the observations from 1825 to 1890.

In addition to the above, a discussion of 718 observations of the pole star, made with the Pulkowa vertical circle between 1882 and 1891, was given. This series is especially interesting and important, in that it covers an interval during which we have very little other information, of an extended character, as to the variations of latitude. A comparison of the curves of observation and theory, prepared for this decade, exhibited a most striking accordance, and apparently leaves no possible doubt that Nyren's inference (that his observations do not betray evidence of the existence of the annual component of the polar motion) is erroneous, and attributable to illogical methods in drawing his conclusions.

* Abstract of a paper read before the National Academy of Sciences, at Washington, April 21.

CLEANING HARDWOOD FLOORS.

People who are interested in cleaning off hardwood floors may be glad of some hints on the subject from the practical little journal called the Bautechnische Zeitschrift, which the American Architect translates as follows: Where oil colors or varnishes are to be removed from the surface of floors or furniture, it is usual to treat them with soda. As a rule, a solution of ordinary washing soda is employed, and applied cold. This in time accomplishes its task, but its action is slow, and not very efficient. A far better way is to use caustic soda, which can be bought in iron cans, and use the solution hot. With a hot lye of this sort oil color can be removed in a few minutes, and varnishes nearly as rapidly.

As the solution attacks the skin, it should be applied with a cotton or hemp swab. A bristle brush is useless for the purpose, as the bristles dissolve almost immediately in the lye, leaving nothing but the handle of the brush, while cotton or hemp are not affected. When the wood is clean, it should be well washed with water. The strong soda lye darkens the color of oak, but, if this is objectionable, it can easily be corrected by brushing the wood over with dilute muriatic acid, washing it thoroughly as soon as the color is satisfactory, and finishing with a weak solution of soda, to neutralize the last traces of acid. In applying the acid, neither cotton nor hemp can be used, as they are quickly destroyed, but bristle brushes are not affected unless they are bound with iron.

In general, care should be taken never to use muriatic acid in rooms or workshops where iron tools are lying about, as the vapor, even from dilute acid, is quickly diffused through the rooms, and attacks all iron or steel that it can reach. The best way is to make all acid applications in the open air. It is hardly necessary to say that cotton or linen clothes should be worn in using the soda lye, as a drop of lye, falling on woolen cloth, immediately makes a hole.

HORSELESS CARRIAGES AT THE BRUSSELS EXPOSITION.

It is especially desirable that all forms of automotors manufactured in the United States be exhibited at the International Exposition at Brussels next summer. Not only is the Belgian far behind us in this line of invention, but the "horseless carriage" has a great attraction for him, and even his Majesty King Leopold II has expressed a special interest in them, and, unless the American section contains such a display, it will be a great disappointment to many and a falling short of what is expected of American ingenuity. The streets and roads of Belgium are especially adapted to this method of locomotion, and an exhibit would not only attract a great deal of attention, but could hardly fail to be a success from a commercial point of view. Details in regard to the exposition and the steps to be taken in making an exhibit can be obtained by addressing the Commissioner General, Prof. J. H. Gore, the Columbian University, Washington, D. C.

BATS AND MUSIC.

On more than one occasion I have drawn attention in these pages to the influence of man's civilization on wild animals. For the past month I have noticed that a common species of the small bat, probably the pipistelle, which frequents the towns in southern France, congregates in the evenings about those cafés where it is the custom to have outdoor music. This does not seem to apply to any particular town, as they are to be seen flitting about in the crowded streets among all the traffic in Marseilles, Cannes, Nice, and Monte Carlo. So tame are some individuals that they hawk about for flies under the awning which covers the chairs placed on the footpaths. It may be said they come for the flies attracted by the electric lights, but the bats are far more numerous near those cafés where there is music than around the ordinary arc lights in streets or before shops. The inference appears to be that they find pleasure in the presence of music.—John T. Carrington (Beaulieu, Alpes Maritimes), in Science Gossip.

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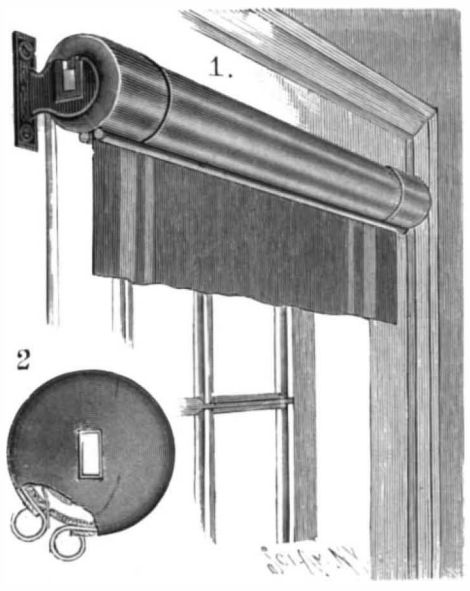
A WINDOW SHADE CASING.

The illustration represents a simple, durable, and inexpensive casing, which may be readily applied to and supported by the ordinary window shade, to protect it from dust, and also to clean the fabric of the shade when the latter is rolled up into the casing.

The improvement has been patented by Charles F. Kraemer (P. O. box 128), College Point, L. I., N. Y. On the ends of the casing are fitted to slide heads to lengthen or shorten the device according to the width of the shade, one head having a rectangular opening for a fixed trunnion of the shade roller, and the other head having a central aperture for a revolving trunnion. The heads are so adjusted lengthwise on the casing that the ends of the trunnions project the desired distance to properly engage the bearings in the usual manner, the shade roller being of the ordinary spring-roller type. Into the longitudinal slot on the under side of the casing, through which the shade extends, are projected strips of felt or similar material, adapted to engage the webbing of the shade and wipe it as it is unwound from or rewound upon its roller, thus keeping the shade clean and preventing any dust from passing through the slot to the inside of the casing. The casing is wholly supported by and carried on the shade itself, and the shade with its casing may be readily removed and replaced as desired.



KRAEMER'S SHADE PROTECTING CASING.

A NEW ELECTRIC LAMP.

If the bicyclist is not supplied with every conceivable accessory that can minister to his convenience when on the road, it will not be for want of diligence and ingenuity on the part of the inventor. In the accompanying illustrations are shown two views of "The Chloride Electric Light," in which it is sought to avoid such defects as the various oil and gas bicycle lamps may be liable to, by making use of electricity. The external appearance of the lamp is certainly in its favor. It is moulded on simple lines and is free from any excess of moulding or embossing which would catch the dust and render the lamp difficult to clean. The body of the lamp, which is formed of a light, tough insulating material, is divided internally by a vertical diaphragm which forms two separate cells.

Projecting from the floor of each cell are two terminals. At the top of the diaphragm and resting on an offset turned in the walls of the lamp is a rubber disk, above which is a false cover, which is pressed down tightly upon the disk when the outer cover seen in the engraving is screwed down in place. The silvered reflector, into the base of which is screwed a small incandescent bulb, is readily accessible for cleaning, the glass with its cap being pressed on and then locked by giving it a slight turn to the right. Accompanying each lamp are several sets of plates that have been charged with electricity; two plates and two zinc elements being placed in the lamp, in conjunction with a small amount of "electric salt," give a current sufficiently strong to light the lamp so as to throw a light forty to sixty feet.

The electricity in the plates will be exhausted only as the light is used. When the lamp is not in use, the light can be extinguished by changing the location of the small switch shown in the front of the lamp. The capacity of the plates for about two hours' use in the evening is, for a good light, twelve to fourteen hours. Where the light is burned continuously the plates have a capacity of about ten hours. When entirely exhausted the plates can be removed and new ones substituted, the old ones being reserved and sent back to the agent or manufacturer of the lamp, and recharged. The plates can be recharged indefinitely, and are not affected by climatic conditions.

When the lamp is to be used, as much "salt" as will fill a small measure which is furnished with the lamp is placed in each cell, and sufficient water is added to cover the battery plates. The rubber disk and the false cover before mentioned are put in place; the outer cover is screwed down until a watertight joint is secured, and the lamp is then ready for use. The current is controlled by the small switch seen below the reflector, the switch being placed on the upper point, as shown in Fig. 2, when the lamp is first charged, and moved to the lower point in about three hours' time, or when the plates become somewhat exhausted. At the end of the ride the contents are poured out of the lamp, and the zinc elements are carefully washed in water.

For use on the bicycle, the lamp is provided with a thumb screw clamp shown in Fig. 1.

The Electric Portable Lamp Company, of Elmira, N. Y., also makes a lamp of this kind for the use of miners. This lamp is provided with a screw button by which it can be fastened snugly against a plate attached to a stout leather belt and carried around the waist. A steel bracket is also provided which enables the lamp to be carried in one's hand or hung up in the mine. (See Fig. 2.)

In addition to the uses above mentioned, the lamp is adapted for carriages, and may be carried by policemen, night watchmen, etc.

Fig. 1.—NEW ELECTRIC BICYCLE LAMP.

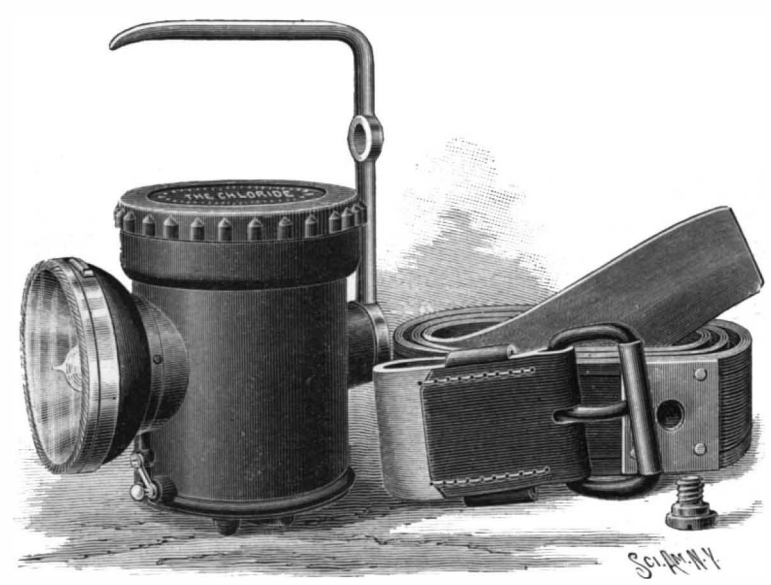


Fig. 2.—ELECTRIC LAMP FOR THE USE OF MINERS.

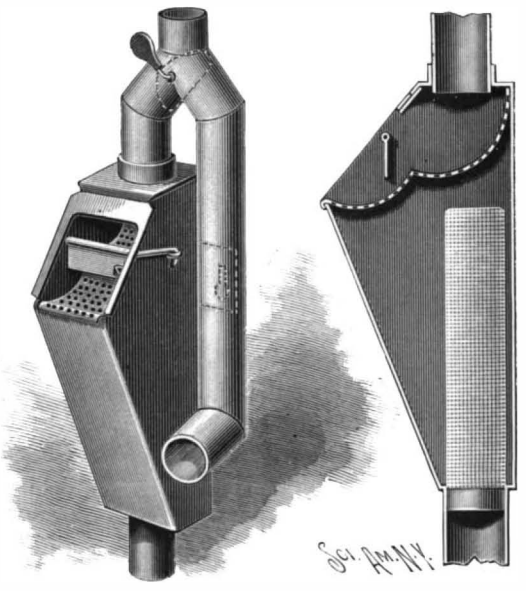
The Log of the Mayflower.

The manuscript log of the Mayflower has been awarded to the United States at a sitting of the Court of London.

The court was held in St. Paul's Cathedral and was presided over by the chancellor of the Diocese of London. A petition was presented by Mr. Bayard, Ambassador to the Court of St. James, for an order directing that the log of the Mayflower, which was then in the library of Fulham Palace, be transferred to the custody of the United States as one of the earliest records of their national history. Mr. Statham, who appeared in support of the petition, said that the manuscript in question contained an inscription which showed that it belonged to the New England library. It contained, he said, valuable information in regard to the original settlers of the New England States to the end of the first twenty-eight years of the colony. It is believed the book was taken to England before the revolutionary war by Hutchinson, Governor of Massachusetts, who collected historical material. The original manuscript book was produced in court and handed to the chancellor of London. The secretary to the Bishop of London said that his lordship concorded in the petition. The chancellor of London then cited a precedent and adjudged the book to the custody of the United States, on condition that a notarial copy be left on the register of the court. Photographic reproductions of the book will be made and deposited at Fulham Palace.

THE "NEW IDEA" RAIN WATER FILTER.

The accompanying illustration represents a filter adapted to be attached to a building in connection with the rain spout or gutter, the figures showing the filter in perspective and sectional views. The improvement has been patented by Nathan H. Long, and is being introduced by the "New Idea" Filter Company, Muncie, Ind. The back of the main portion of the filter, adapted to rest against the side of the house, has side flanges, in each of which is a slot to receive a screw in attaching the filter to a building, and in the front upper portion of the filter is removably held a water filtering and dirt discharging shoe, retained in position by a flange extending forward from the hood and another flange at its front edge. The upper, rear portion of the shoe serves as a dam in connection with a hinged flap or shutter, the hinged shutter raising sufficiently, however, to permit the water to force the accumulated dirt across the front portion of the shoe and to the ground, while serving to prevent the water from splashing out over the front of the shoe. Hooks at the side also hold the shutter in position. The water entering through the filtering shoe is also further filtered by having to pass through a reticulated cylinder or tube supported on the upper end of the pipe leading to the cistern. The pipe connecting with the gutter or eaves trough has a branch connection with the filter, while another branch represents the waste water discharge pipe, through which water is passed when the cistern is full, or when it is otherwise not desired to pass water through the filter. To direct the water in either direction a valve or shutter is pivoted at the junction of the pipes, the valve being turned as desired by a handle or rod to close either pipe section, and thus carry the water through the filter or through the waste pipe.



LONG'S RAIN WATER FILTER.

Building in New York.

The work of the building department of New York City during the first nine months of 1895 and 1896 is shown by the following table, which is taken from the quarterly report of Mr. Stevenson Constable, superintendent of the department of buildings:

	1895.	1896.	Increase in 1896.
Applications filed, new buildings and alterations	4,228	5,416	1,188
New buildings commenced	2,164	2,175	11
New buildings completed	1,703	2,480	777
Alterations commenced	1,094	1,465	371
Alterations completed	1,105	1,546	441
Iron and steel beams, girders, etc	58,106	161,162	103,056
Violations of the law reported by inspectors	3,843	4,754	911
Buildings reported by inspectors as unsafe	1,705	2 666	961
Notices issued	10,704	39,457	28,753
Number inspections made of passenger elevators	2,632	4,257	1,625
Unsafe buildings made safe or taken down	1,204	2,510	1,306
Violations removed	2,722	4,628	1,906
Cases forwarded attorney for prosecution	2,714	2,772	58
Passenger elevator cases to attorney for prosecution	16	182	166
Defective passenger elevators reported by inspectors	62	856	794
Made safe on notice from department	44	912	868
Notices of suits issued	5 075	5,284	209
Cases disposed of by attorney	2,841	4,522	1,681
Totals	101,962	247,044	145,082
Money collected by the attorney	$5,778	$14,337	$8,558

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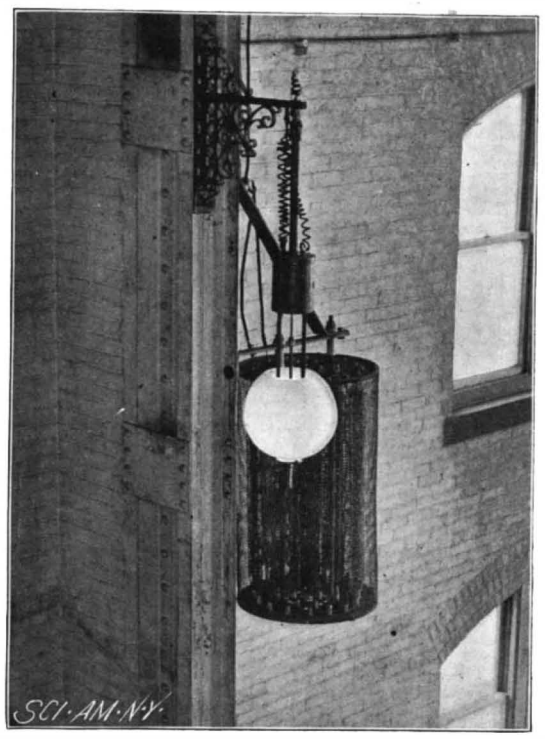
THE ELECTRIC HEATING OF THE GENERATING STATION OF THE NIAGARA FALLS POWER COMPANY.

BY ORRIN E. DUNLAP.

The Niagara Falls Power Company's big power station offers one of the most interesting studies on the subject of electrical heating to be found in the United States, if not in the world. The power station is a beautiful structure built of Queenston limestone. It is in the Moorish style of architecture. The fact that the roof of the great building is free from and unbroken by chimneys excites the attention of approaching visitors, and many are at a loss to know how to account for the unusual appearance of the structure on its exterior until they get inside and realize that the pleasing warmth is due to electrical heat, and that no other heat is employed about the building. The power house is divided into the dynamo room and the office quarters—a fact which makes necessary two series of heaters. The heaters in the offices are on a secondary 100 volt circuit, and this circuit is fed through converters which reduce the voltage from 2,000 to 100. In the office portion of the power house there is about 175 horse power in heaters of the American pattern, but they are seldom all on at the same time. Of course, it depends entirely upon the weather conditions as to the amount of heat required to make the rooms comfortable. The office occupied by the electrical superintendent, Mr. Paul M. Lincoln, is about 20 by 15, by 9 or 10 feet high. In this room are two heaters, each of 7 horse power, making a total in the room of 14 horse power, and in zero weather both are necessary to give comfort.

In the dynamo room there are fifteen heaters, three circuits of five each, and each circuit takes up about 200 horse power. However, it has never yet been found necessary to use all three circuits, two of them being found sufficient in the coldest weather. By consulting the illustration in connection with this article the heaters will be seen on the left on the walls of the dynamo room, about 15 feet above the floor. This method of placing them was adopted partly as a means of safety, but it serves nicely in distributing the heat midway between the roof and the floor. The current for heating the dynamo room is taken from the 'bus bars and carried on No. 4 rubber-covered wire, while that for heating the office portion of the building is taken from the primary of the circuit which feeds the street railways about Niagara Falls. As each heater takes up about 40 horse power, it will be seen that to put in converters to convert the power down to 100 volts would be quite expensive, and consequently the current is taken direct from the 2,200 volt circuit.

The heaters in the dynamo room are made of two circular rolled iron plates which are about ⅛ inch thick and twenty-four inches in diameter. Bolts hold these plates parallel, about 4 feet apart, one above the other. Each plate has about 28 holes in it, and the diameter of each hole is about ½ inch. In each of these holes is placed a porcelain insulator having a pretty large head, and through the insulators No. 6 iron wire is strung. There are 38 coils, and each coil is about 1½ inches in diameter, the distance between convolutions being about twice the diameter of the wire; at least, it is such that the resistance of the heaters will take about 65 amperes at 440 volts, so that all five heaters, in series, will consume 2,200 volts at 65 amperes. The heaters were designed by Mr. Paul M. Lincoln, and made by Dobbie, Stuart & Company, of Niagara Falls. Heaters of very similar pattern are in use in the power station of the Niagara Falls Park and River Railway Company, in Queen Victoria Park, on the Canada side



ELECTRIC HEATERS USED AT NIAGARA

of the river, the voltage on these latter heaters being 500.

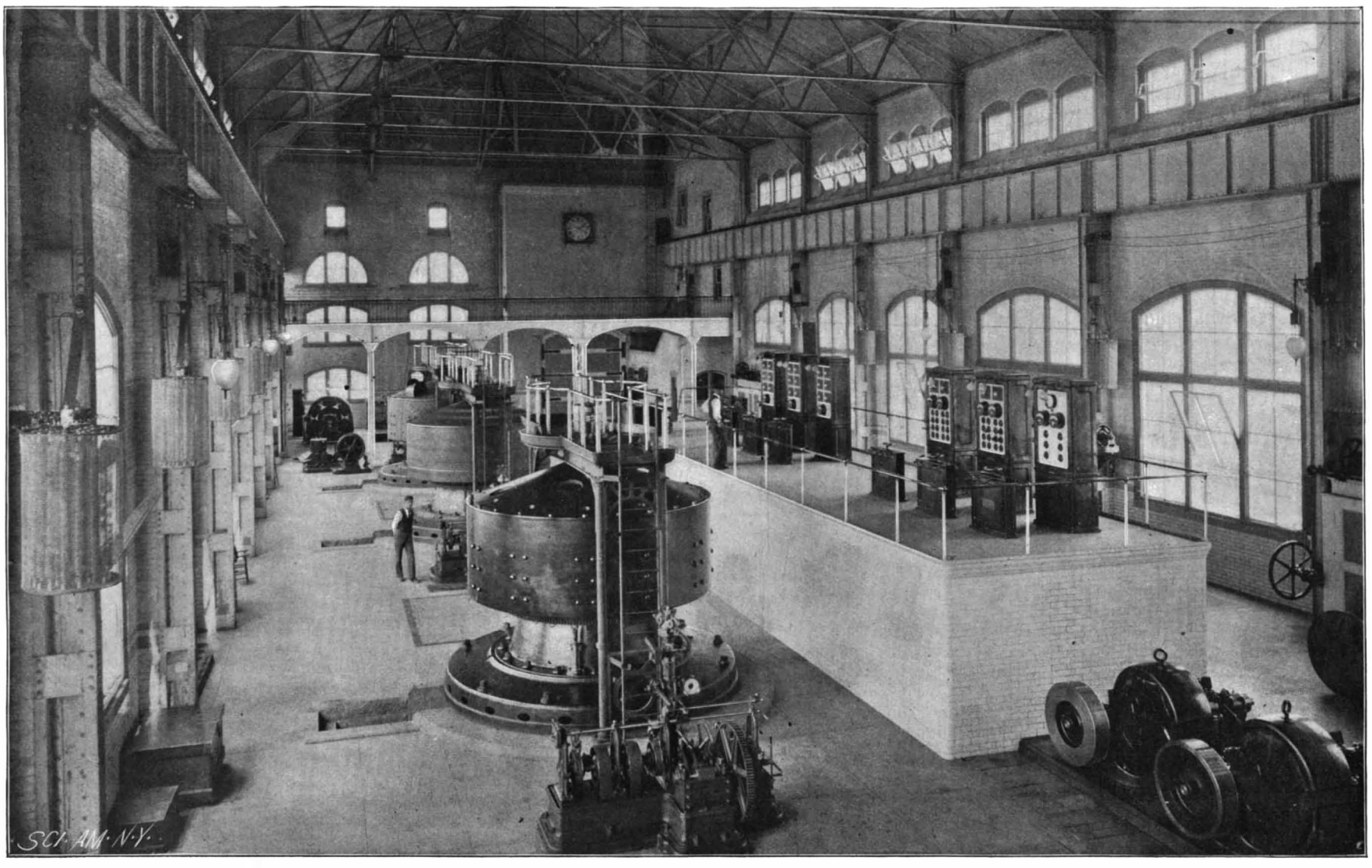
The maximum amount of power used in heating the dynamo room and office portion of the central station of the Niagara Falls Power Company is about 420 or 430 horse power, but it must be understood that this is not counting the heat from the dynamos, which is, indeed, an important factor so far as the dynamo room is concerned. At the present time there are three dynamos in the station, each of 5,000 horse power capacity. As a general thing, two of these machines are running at the same time. Now if each machine was being run so as to give 4,000 horse power, instead of at its full capacity, and three per cent of this power was lost in heat, each of the dynamos would contribute no less than 120 horse power to heating the dynamo room, or from the two machines generally in use 240 horse power would be obtained. This estimate of the power from the dynamos lost in heat is not any too large, a fair average being from 2½ to 4½ per cent. Add the 240 horse power from the dynamos to the amount of power consumed by the heaters when all are in service, and it will be seen that nearly 700 horse power is consumed in heat in the entire building. It is fair, however, to state that when two dynamos are in operation the additional heat thrown off makes unnecessary the use of all the heaters.

Internal Rays.

Prof. S. P. Thompson, in a letter to L'Eclairage Electrique, explains the distinctive properties of a new kind of rays, which he has discovered inside the X ray tube, and which he calls "internal rays." These rays, which we have already shortly described in our report of the British Association meeting at Liverpool, says the English Electrical Review, differ from the Roentgen rays in being deflectable by a magnet, and from the cathode rays in being given off in every direction from the surface of the anti-cathode. Prof. Thompson's attention was first drawn to these rays by observing that the boundary line of the fluorescence in a focus tube was displaced by a magnet, while no displacement of the corresponding line on a fluorescent screen held outside the tube was observed. Evidently, then, there were some deflectable rays flowing along with the Roentgen rays inside the tube, but unable to pass with the latter through the glass. These rays do not appear to us to be so different in kind from the Roentgen rays as to require to be characterized by a special name. If Lenard's theory of the difference between the cathode and the Roentgen rays be correct, the two kinds of rays regarded from the point of view of magnetic deflectability pass into each other by insensible gradations. Though Prof. Thompson says internal rays do not pass through glass, they may be able to pass through the sides of an aluminum tube, in which case they would merely be a variety of our old friends the Lenard rays. There appears to have been a great tendency lately among X radiationists to mistake mere varieties for new species.

A CONTEMPORARY is responsible for the following paragraph; the SCIENTIFIC AMERICAN disclaims any responsibility for its accuracy:

In China the hen is kept constantly busy. When not engaged in hatching her own brood, she is compelled to hatch fish eggs. The spawn of fish are placed in an eggshell, which is hermetically sealed and placed under the unsuspecting hen. After some days the eggshell is removed and carefully broken, and the spawn, which has been warmed into life, is emptied into a shallow pool, well warmed by the sun. Here the minnows that soon develop are nursed until strong enough to be turned into a lake or stream.



GENERATING STATION OF THE NIAGARA FALLS POWER COMPANY, SHOWING THE ELECTRIC HEATERS.

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Science Notes.

Great interest has been created in astronomical circles by some of the results reached by Prof. Simon Newcomb in his more recent investigations. One of these is that astronomers have been overestimating the distances of the stars; and the other, that our universe has after all a fairly well defined limit. The first of these conclusions Prof. Newcomb bases on an idea that the stars which are called the smaller ones, because they are less bright, may not be large stars at a very great distance, but perhaps smaller or dimmer ones nearer at hand. The old idea is familiar to all, namely, that all the stars are of the same brightness, and that the fainter ones are at a very much greater distance from us than the bright ones; this theory, however, has been weakened by later discoveries, such as, for example, that Sirius has a companion whose light, if equal surfaces be considered, is but a fraction of that of its principal; and astronomers have come to recognize dim stars, or even dark ones, like the companions of Algol, about which so much has lately been written, to be quite as common, perhaps, in the universe as the bright ones. Prof. Newcomb's proposition as to the limits of the universe is regarded as even more novel and striking, suggesting, as it does, the possibility that some day all the stars will be seen.

Quite recently a considerable number of additions to our knowledge of the Roentgen rays and their applications have been published, says Nature. From Prof. Hobday we have just received a reprint of his and Mr. V. E. Johnson's joint paper in the Veterinarian for September, dealing with the use of these rays in veterinary practice, illustrated by several excellent radiographs of the hoof and hock of horses, both normal and abnormal. In the Bulletin of the Belgian Royal Academy, M. L. N. Vandevyver enunciates the empirical law that the length of exposure for radiographs through limbs of different dimensions varies as the cube of their thickness, and the illustrations which accompany the paper afford ample corroboration of the law from a practical point of view. The journal of the Camera Club for December contains the account of a lecture, by Prof. Rüker, on the transparency of glass and porcelain to these rays, from which it appears that the presence of phosphates in china is indicated by their greater opacity, a result which might naturally be expected to follow from the considerable opacity of bone to Roentgen rays. M. Bouchard, in a communication to the Paris Academie des Sciences, states that Roentgen rays can be successfully employed in diagnosing pleurisy and similar complaints.

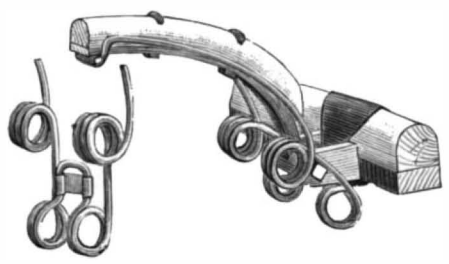
In the current number of the American Journal of Science Prof. R. S. Tarr, of Cornell University, has a paper giving the results of observations of climate and geological changes in Greenland and the American sides of Baffin's Bay. The observations were made during a voyage last summer. On the American shore were found great floes of ice, the coast bleak, and heavy snow banks on the land in July. On the Greenland coast, hundreds of miles northward, flowers were in blossom, insects abundant, and the air balmy, storms bringing rain and not snow. This difference, which has heretofore been noted and attributed to difference in the temperature of ocean currents, Prof. Tarr partly assigns to warm winds, including that from the Greenland ice cap, which was found warmer than that from the sea, the explanation being the same as that for the chinook wind. Prof. Tarr found in Baffin Land and Labrador evidences of former glaciation which came when the land was higher than now, but the American land is now in a reverse movement of uplift, while on the Greenland coast there is submergence of land at present in progress. In conclusion Prof. Tarr raises these queries: "Is Greenland now passing through the stage of ice withdrawal from which the American, Labrador, and Baffin Lands have so recently escaped? And is there any relation between the downsinking of Greenland and the uprising of Labrador and Baffin Land? Is the ice withdrawal directly due to the land movement, and is the load of ice really the cause for the sinking which allows its withdrawal? That is, does the ice increase in area and extent with no other result than its own destruction by depressing the land, and hence removing the cause of supply?"

Value of "Useless" Research.

The report of the British Association's committee on the establishment of a national physical laboratory, after referring to what is done and what can be done for promoting research by the universities and schools and other existing institutions, specifies particular types of investigation which are outside the range of effort possible for such institutions or for an individual—such as observations of natural phenomena, the study of which must be protracted through periods longer than the average duration of human life; testing and verification of physical instruments and preservation of standards; and the systematic and accurate determination of physical constants and numerical data which may be useful for scientific or industrial purposes. In the discussion of this report, Prof. Fitzgerald opposed divorcing the universities from research, but hoped they would teach the usefulness of "useless" research, while investigations of commercial importance should be relegated to a national laboratory. Prof. Kohlrausch, of the Physical Training Institute (the Reichsanstalt) at Berlin, showed how completely that institution was answering the purposes for which it was founded, illustrated in the great development of the technical glass industry, particularly of thermometer making; the improvement of photometers and standards for measuring light; and researches in apparatus for measuring furnace temperatures. Scientific discovery, he declared, whether costly or cheap, is, in its results, beyond price, for you never know whether the abstract discovery will not lead to inventions of great industrial importance. He could point to quite small physical discoveries which later received great technical applications, says the Popular Science Monthly. When Huygens investigated the singular double refraction of calcareous spar, no one supposed that so small a point in physics would have a commercial value over the whole world in the sugar industry and in brewing.

A THILL SUPPORT AND ANTI-RATTLER.

The simple and effective device shown in the accompanying illustration has been patented by Granville Bartlett, of No. 360 South Broadway, Lexington, Ky. It is preferably made of heavy wire or rod bent upon itself at the middle to form a curved hook or tongue-like portion, as shown in the small figure, this portion in use engaging the thill eye, below which extend coils from which side wings extend upward and forward,



BARTLETT'S THILL SUPPORT.

adapted to bear against and lock the bolt head and nut from turning. There are upper coils above the nut and bolt head, and forwardly extending arms for connection with or on which the seat of the thill is formed. By arranging the lower coils to carry only a small portion of the weight of the thills, the wear on the hook, thill eye and bolt is much less than if the entire weight of the thills was borne by the lower coils.

Discovery of the Eggs of the Pearly Nautilus.

In a communication to the Times, Prof. E. Ray Lankester says: The pearly nautilus is the only living representative of the great group of extinct animals whose shells are known as ammonites. So rare were specimens of the animal itself that twenty years ago I paid £18 for two preserved in spirit. Yet they are trapped in baskets like lobster traps by the natives of some of the Melanesian Islands and used as food. The structure of the animal is extremely curious, and an admirable account of it formed the first and in many respects the ablest scientific memoir produced by Sir Richard Owen. The nautilus is allied to the cuttle-fishes, but differs from them in most interesting ways. To fully understand its structure and the mode of building up of its chambered shell, it is necessary to know its young stages while it is growing and forming within the egg. To gain this knowledge will be a great triumph; it has been one of the few important embryonic histories not yet ascertained by the enterprise of latter day naturalists. Dr. Arthur Willey proceeded first to Ralum, in New Britain, where he spent a year trapping the nautilus in 70 fathoms of water and dredging in vain for its eggs. He then tried a station on the coast of New Guinea, where he was nearly drowned by the capsizing of his small craft. After passing through New Caledonia, he arrived last summer in Lifu, one of the Loyalty Islands, where nautilus can be captured in three fathoms depth only. Here he constructed a large submarine cage in which he kept specimens of nautilus, feeding them daily. On December 5 last his patient endeavors were rewarded. Some of the nautili had spawned in the cage, and thenceforward he was able to obtain abundant samples of the eggs. Each egg is as large as a grape, and is deposited separately by the mother nautilus. At present we have received but few further details from Dr. Willey, but he has doubtless by this time obtained the young in all stages of growth, and will return to England with the materials for a most important memoir. Dr. Willey's success was announced (on February 3) from the chair of the Royal Society by Lord Lister. Dr. Willey was enabled to undertake this quest by his appointment to the Balfour studentship, founded by general subscription in memory of Frank Balfour, whose heart would have been rejoiced by the work thus carried out in his name. He was also assisted by the government grant fund of the Royal Society. It is a legitimate source of gratification to British men of science that a successful result has followed from the application of these funds. By aid of the same funds Mr. Caldwell twelve years ago discovered the eggs of the Australian duck mole and echidna, and the larval stages of the remarkable fish ceratodus of Queensland—an animal which, like the nautilus, is a survival of most ancient extinct forms.

The Canal of Joseph.

How many of the engineering works of the nineteenth century will there be in existence in the year 6000? Very few, we fear, and still less those that will continue in that far-off age to serve a useful purpose. Yet there is, at least, one great undertaking conceived and executed by an engineer which during the space of four thousand years has never ceased its office, on which the life of a fertile province absolutely depends to-day. We refer to the Bahr Joussuf—the canal of Joseph—built, according to tradition, by the son of Jacob, and which constitutes not the least of the many blessings he conferred on Egypt during the years of his prosperous rule. This canal took its rise from the Nile at Asiut, and ran almost parallel with it for nearly two hundred and fifty miles, creeping along under the western cliffs of the Nile valley, with many a bend and winding, until at length it gained an eminence, as compared with the river bed, which enabled it to turn westward through a narrow pass and enter a district which was otherwise shut off from the fertilizing floods on which all vegetation in Egypt depends. The northern end stood seventeen feet above low Nile, while at the southern end it was at an equal elevation with the river. Though this cut ran a perennial stream, which watered a province named the Fayoum, endowing it with fertility and supporting a large population. In the time of the annual flood a great part of the canal was under water, and then the river's current would rush in a more direct course into the pass, carrying with it the rich silt which takes the place of manure and keeps the soil in a constant state of productiveness. All this, with the exception of the tradition that Joseph built it, can be verified to-day, and it is not mere supposition or rumor. Until eight years ago it was firmly believed that the design has always been limited to an irrigation scheme, larger, no doubt, than that now in operation, as shown by the traces of abandoned canals, and by the slow aggregation of waste water which had accumulated in the Birket el Querum, but still essentially the same in character. Many accounts have been written by Greek and Roman historians, such as Herodotus, Strabo, Mutianus and Pliny, and repeated in monkish legends, or portrayed in the maps of the middle ages, which agreed with the folk lore of the district. These tales explained that the canal dug by the ancient Israelite served to carry the surplus waters of the Nile into an extensive lake lying south of the Fayoum, and so large that it not only modified the climate, tempering the arid winds of the desert and converting them into the balmy airs which nourished the vines and the olives into a fullness and fragrance unknown in any part of the country, but also added to the food supply of the land such immense quantities of fish that the royal prerogative of the right of piscary at the great weir was valued at £250,000 annually. This lake was said to be 450 miles round, and to be navigated by a fleet of vessels, and the whole circumference was the scene of industry and prosperity.—Engineering.

Aluminum Coated Sheets.

A new departure in the field of sheet metals has just been undertaken by a St. Louis, Mo., firm. This firm have sent us, says the Metal Worker, samples of steel sheets coated with aluminum, which, it is claimed, are superior to and more durable than galvanized iron, tin plate or planished iron for many purposes for which those materials are now generally used. The special advantages of the aluminum coated sheets are stated to be that they can be worked and seamed without peeling, the coating adhering absolutely to the sheet, can be easily soldered, will resist the action of sulphurous gases and can be heated to a red heat without destroying the coating. Moreover, they can, when desired, be polished to a luster equal to burnished silver or nickel. The samples in our possession show that the work of coating is very completely done, the sheets presenting an absolutely smooth and evenly covered surface, free from imperfections of any kind. In their unpolished state the sheets have a dull, silvery appearance, and when polished look exactly like nickel plate. The firm are also producing aluminum coated sheets plated with copper, which are designed for use in most cases in which pure copper sheets are now employed. These also take a high polish.

The feasibility of coating iron with aluminum was demonstrated some years ago at the works of the Tacony Iron and Metal Company, Tacony, Pa., where all the iron plating for the dome of the tower of the Philadelphia Public Buildings was given a coating of aluminum by the electrolytic process. In this case, however, a coating of copper was deposited on the iron before the aluminum was applied. In the sheets furnished us by the St. Louis company the aluminum appears to be deposited directly on the steel.

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THE GRANT MEMORIAL TOMB, NEW YORK CITY.

THE DEDICATION AND PRESENTATION.

On Tuesday, April 27, 1897, the anniversary of the great soldier's birthday, the Grant Memorial Tomb was dedicated, amid stately ceremonials which called to mind the transfer of the body of that other soldier-hero, Napoleon I, to its resting place in the Hotel des Invalides, Paris.

The arrangements for the memorial services at the tomb included an opening prayer by Bishop Newman, who was General Grant's pastor and personal friend; an address by President McKinley, as the chief representative of the nation; an oration by Gen. Horace Porter, who, in his closing words, delivered the tomb into the keeping of the city; the acceptance of the tomb by Mayor Strong, on behalf of the city; and the singing of the Doxology by the assembled multitude.

Earlier in the morning the vast parade, numbering some 50,000 men, had started far down in the heart of the city on its long march to the tomb. It was headed by the military grand division, composed of 4,000 regulars and marines, 20,000 men of the National Guard, representing the various Eastern States, and 4,000 cadets. This was followed by the Veteran grand division, containing 10,000 men, and following this was the civic division, containing fully 10,000 more. Up the broad expanse of the Hudson River, below the tomb, there was meanwhile moving an imposing naval parade in four divisions. The first of these consisted of the North Atlantic Squadron and the foreign war vessels. The next was composed of other vessels of the navy and those of the United States Lighthouse Department. Then followed the revenue cutters of the government, and the last division was made up of vessels of the merchant marine. Altogether it may be said that the dedication ceremonies were worthy of the occasion, and will be recorded as one of the most memorable and splendid functions in the history of the metropolis.

Immediately upon the death of General Grant, which took place July 23, 1885, the question arose as to where his remains should be interred. The claims of Washington were set aside in favor of those of New York, mainly because of the wish of the General, expressed to his son in the last days of his sickness, that he should be buried in the latter city. In February, 1886, the Grant Monument Association was organized with ex-President Arthur as chairman, and up to this time contributions to the amount of $114,000 had been received.

In September, 1890, as the result of a competition by a number of prominent architects, the plans of Mr. J. H. Duncan, of New York City, were adopted for the construction of the present handsome structure. The estimated cost was to be between $500,000 and $600,000. Work was commenced on the foundations on April 27, 1891, the anniversary of the dead soldier's birthday, and shortly afterward a contract was let for the first ten feet of the granite work. At this time only $155,000 had been secured, and it was determined by the association, under the new presidency of General Horace Porter, to make a vigorous effort to secure the balance of the necessary money, or about $350,000. An appeal for a popular subscription was made, and within sixty days the whole amount had been realized. The corner stone of the tomb was laid by General Harrison, who was then President of the United States, on April 27, 1892, and shortly after this, the funds of the Grant Monument Association had reached the handsome figure of $600,000, or sufficient to carry out the plans of the tomb in their entirety. It was estimated that the total number of contributors during the sixty days was 64,788, each of whom gave on an average $6.23. If the contributors to the original $155,000 be added to these, it is found that the present memorial represents the personal tribute of fully 90,000 people.

The Memorial Tomb stands at the northern end of the beautiful Riverside Park, and it would certainly have been difficult to have found a more fitting site. The base of the structure is 130 feet above the Hudson River, and the summit of the pyramidal mass above the dome will be 280 feet above the same level. This commanding site enables the classic outline of the mausoleum to be seen over a wide area of the adjacent country, and the beauty and grandeur of the prospect from Riverside Park will render this hallowed spot doubly attractive to the pilgrims, who in future years will come from far and near to pay tribute to the memory of the great general of the Union armies.

The external appearance of the tomb is massive, dignified and sincere—and so far it represents leading characteristics in the man whose remains have been entrusted to its keeping. The lower half is square in plan, measuring 90 feet on a side, and is built on the Grecian Doric order. The entrance, which is on the south side, is approached by a flight of steps 70 feet wide, which lead up to an imposing portico formed of two lines of massive columns. This is enriched with carvings of the coats of arms of the different States and designs of weapons and battle flags. It is ultimately intended to place a colossal equestrian statue of General Grant in front of the portico.

The large engraving on the first page shows the tomb as at present completed. The original design calls for the placing of equestrian statues of the four most prominent generals who served under Grant over four of the Doric columns of the portico. Others who held high command will be shown in bass relief in panels on the eastern and western sides of the building. The lower square portion of the structure is finished with a handsome cornice and a parapet at a height of 72 feet above the ground. Rising directly above this is a circular cupola built on the Ionic order, which is 70 feet in diameter, and is relieved by a handsome circle of Ionic columns and a gallery. The cupola terminates in a stepped or terraced pyramid, which it is ultimately intended to crown with an appropriate group of statuary. The design also calls for statuary at the four corners of the lower portion of the tomb.

The building is constructed throughout of a particularly flawless and durable granite, brought from North Jay, Maine. It is remarkably white and marble-like in appearance, and in the clear atmosphere of a sunny New York day is readily mistaken for the latter stone. The ground plan of the interior of the tomb is cruciform, the greatest distance between opposite walls being 76 feet. The corners are occupied by four massive masonry piers which serve to carry four coffered arches, that rise, at the crown, to a height of 50 feet above the floor. Immediately above the arches is a circular gallery 40 feet in internal diameter, from which the visitor may look down upon the floor and the crypt below. The engraving upon the front page, which is taken from one side of this gallery, shows the general beauty of the interior design and the richness of the decorations. The gallery is lighted by windows which command a superb view of the Hudson River and the surrounding country. One of our illustrations is a view from this point looking up the Hudson. Above the gallery is a paneled dome, the springing of which will be noticed in the illustration. The spaces between the arches and the circular dome are decorated in high relief sculpture, which is emblematic of events in the life of General Grant.

Directly beneath the dome and in the center of the main floor is a circular opening, through which the visitor can look down into the crypt, in which is placed the massive granite sarcophagus containing the body. The crypt proper consists of an open circular space within which is a plain raised square granite platform upon one side of which rests the sarcophagus. The other side is reserved for a similar sarcophagus which will receive the body of Mrs. Grant, the General having expressed a wish that she should rest at his side. The circular space is inclosed by a low wall of marble, from which rise the massive marble columns which carry the ceilings and entablature, and behind these is the circular passage from which our photograph of the sarcophagus was taken.

Such is the Grant Memorial. Within as well as without, the design and details of this truly magnificent mausoleum are marked by an absence of all pretense and an unvarying directness and simplicity which form in themselves a fitting epitaph to the man who sleeps within.

THE HUDSON AND PALISADES NORTH FROM THE GALLERY OF GRANT'S MEMORIAL TOMB.

Concerning Animal Industry.

A person unacquainted with the facts might be puzzled at first to conjecture what the functions were of a "Bureau of Animal Industry" in our system of government. Perhaps something relating to draught horses or the use of dogs in treadmills might suggest itself. In reality, this bureau is a subdivision of the Department of Agriculture, with the human animal performing the labor, which is largely that of the inspection of quadrupeds slaughtered for food, and it can display some remarkable figures to show its industry.

The prodigious number of 35,917,479 meat-producing animals thus underwent official inspection during the last fiscal year, as is shown by a report just printed. Of these, 23,275,739 were inspected at or for slaughter houses and 12,641,740 in stock yards, whence they went to the established abattoirs of other places, or else in the possession of buyers. The number was made up of 7,529,523 cattle, 314,846 calves, 6,318,284 sheep, and 21,754,826 hogs.

The figures thus given are of living animals, ready for slaughter, but last year there were also inspections, officially known as "post mortem," numbering 18,883,275.

The law on the subject covers animals slaughtered or to be slaughtered in the country for sale through the channels either of foreign or interstate commerce. Its enforcement has been a gradual work, as shown by the fact that the number of inspections was over twice as great last year as the year before, and that of the abattoir inspections six times as great as in 1892. What is more, there is to be a further increase of the inspection service, so that its figures will be still more enormous.

That the inspection is not merely perfunctory is shown by another set of facts. Last year the "ante mortem" inspections alone showed that there had been condemned, as unfit for food, 22,356 cattle, 2,837 calves, 13,225 sheep, and 50,981 hogs, making a total of 89,399 animals. These were marked with a condemnation tag, while those that passed muster had a tag showing that fact.

In regard to the 23,275,739 inspections at or for official abattoirs, it is noted that these represent nearly the same number of animals; but as to the 12,641,740 inspected elsewhere there must doubtless be some deductions, as the inspection is made at the scales, and the animals may change hands several times, being weighed on each occasion, and thus must pass the inspector more than once. But the total of different animals inspected must still be enormous.

Among the animals examined the highest ratio of condemnations was in the calves, nearly one in a hundred. The sheep represented only about one in 500, the hogs about one in 400, and the cattle about one in 360.

There was a heavy falling off in the exports of animals for the last fiscal year, and that makes the increase in the number of inspections the more noteworthy. The exports of microscopically inspected pork fell off from 45,094,598 pounds to 22,900,880. But it should be observed that the preceding year had been an unusually heavy pork export year, and besides, there has been an intentional discouraging of microscopical work for countries not requiring that form of inspection, on account of the expense. The number of microscopic inspections the previous year had been 1,910,415, whereas last year it was only 979,380; still it cost $60,486.

It takes almost a regiment of men, counting inspectors, taggers, clerks, microscopists, and laborers, to do all the work. There are examinations of imported as well as exported animals, and there are experiments on animals relating to their diseases. The expense of ante mortem inspections is put at $341,456, or a little less than one cent each, while the total disbursements of the Bureau of Animal Industry were nearly $600,000.

PROF. ALFRED M. MAYER, of Stevens Institute, gives in the American Journal of Science the results of a series of experiments with disks and rings of various kinds of metal floating on water. He refutes the theory that such floating metals must be greased, shows their breaking weight on the water when loaded, and the shape of the water surface, and deduces by methods of his own the values of the surface tension, which agree very closely with those determined by other physicists. Many interesting experiments are shown, as, for example, that a glass rod recently drawn out in a spirit plane and just cold sinks in water; after a freshly made glass rod has remained exposed for about fifteen minutes to the air, it floats; and if it has just sunk in water and is withdrawn, wiped dry, and exposed to the air from ten to fifteen minutes, it will float.

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TRIAL OF SIDE AND DECK ARMOR FOR THE UNITED STATES BATTLESHIPS KEARSARGE AND KENTUCKY.

It is gratifying to note that the Harveyized armor plate which is being manufactured for the United States Navy continues to show in a high degree the qualities of hardness and toughness for which the re-forged plates are famous.

The accompanying engraving was made from a photograph of a test plate which was recently fired at with a ten inch gun at the Naval Proving Ground, Indian Head. The plate was one of a set of face-hardened, reforged, nickel steel plates, which is being furnished by the Carnegie Steel Company for the side armor of the Kearsarge. It measured 7½ feet in height and 16 feet in width and tapered from a thickness of 16½ inches to 9½ inches. The plate was set up with the thick edge of the plate down and the outer surface vertical, the center of the plate being normal with the line of fire. It was backed with 12 inches of oak and ½ inch skin plates. The plate was secured to the structure by six holding-in bolts, and the distance between gun and plate was 334 feet. In the first round a Carpenter shot weighing 500 pounds was fired from a 10 inch breech loading rifle. The striking velocity was 1,293 feet a second and the striking energy 5,802 foot tons.

TEST OF FACE-HARDENED NICKEL STEEL SIDE ARMOR FOR THE KEARSARGE.

Shot No. 1.—Weight, 500 pounds; velocity, 1,293 foot seconds; penetration, 4 inches.
Shot No. 2.— " 500 " " 1,850 " " " 9 "

The projectile struck the plate at the point marked No. 1 in the engraving and smashed to pieces, the head of the shot remaining in the plate. Fifty-nine fragments in all, weighing 78 pounds, were picked up in front of the plate. The effect upon the plate was slight and very local. The backing was uninjured and there was no apparent effect on the skin plates. The estimated penetration was four inches. The diameter of the splash was 10 inches and of the flaking 14 inches. The plate where it was flaked seemed to be of very fine quality. The plate was then attacked with a 10 inch Wheeler-Sterling armor-piercing projectile, weighing 500 pounds, which was of extreme hardness from the point to 1½ inches in rear of the bourrelet. The striking velocity was 1,850 feet a second and the striking energy 11,877 foot tons.

The projectile smashed on the plate, the head remaining embedded. The projectile broke up much less than that of the first round, thirty-two pieces being found in front of the plate, their total weight being 353 pounds, and the largest piece weighed 53½ pounds.

The estimated penetration was 9 inches. The plate was dished at the edges of the flaking to about ¼ inch below the general surface. The backing was uninjured and the skin plates were slightly bulged out at the top edge, where the bolts were carried away in the previous round. The second armor bolt from the right edge in the center row was carried away, and the lead washers of the third and fourth bolts of the same row were sheared off. The excellent behavior of this plate resulted in the acceptance of the group of armor which it represented.

We have also received interesting particulars of the ballistic test of two protective deck plates, 1¾ inches in thickness, manufactured by the same company. They represented a group of plates which will form the protective deck of the United States battleships Kearsarge and Kentucky.

The plates were clamped at the ends without backing, and were set up in such a position as to make an angle of about 7° between them and the line of fire. A 6 inch gun, firing an armor-piercing shell weighing 100 pounds, was used, and the shell was delivered with a striking velocity of about 1,800 feet a second.

The first shot made a gouge in the plate about 27 inches long and dished it to the depth of about 3 inches. The shell was thrown off and was broken into a number of pieces, and the bulge at the back of the plate was uncracked. The result of the test of the second plate was similar to that of the first, except that the back bulge was slightly cracked. In this round, also, the shell was badly broken up. As neither plate showed any injury other than the gouge at the point of impact, they are justly considered to be of very fine quality.

The importance of such deck armor can scarcely be over-estimated. The flat trajectory of modern shells, due to their high velocity, will insure that the angle of impact, when they strike the protective deck, will be comparatively small. The chance of the shell being deflected is further increased by the arrangement of coal bunkers above the armor belt and in the wake of the boilers and machinery.

The Largest Automobile.

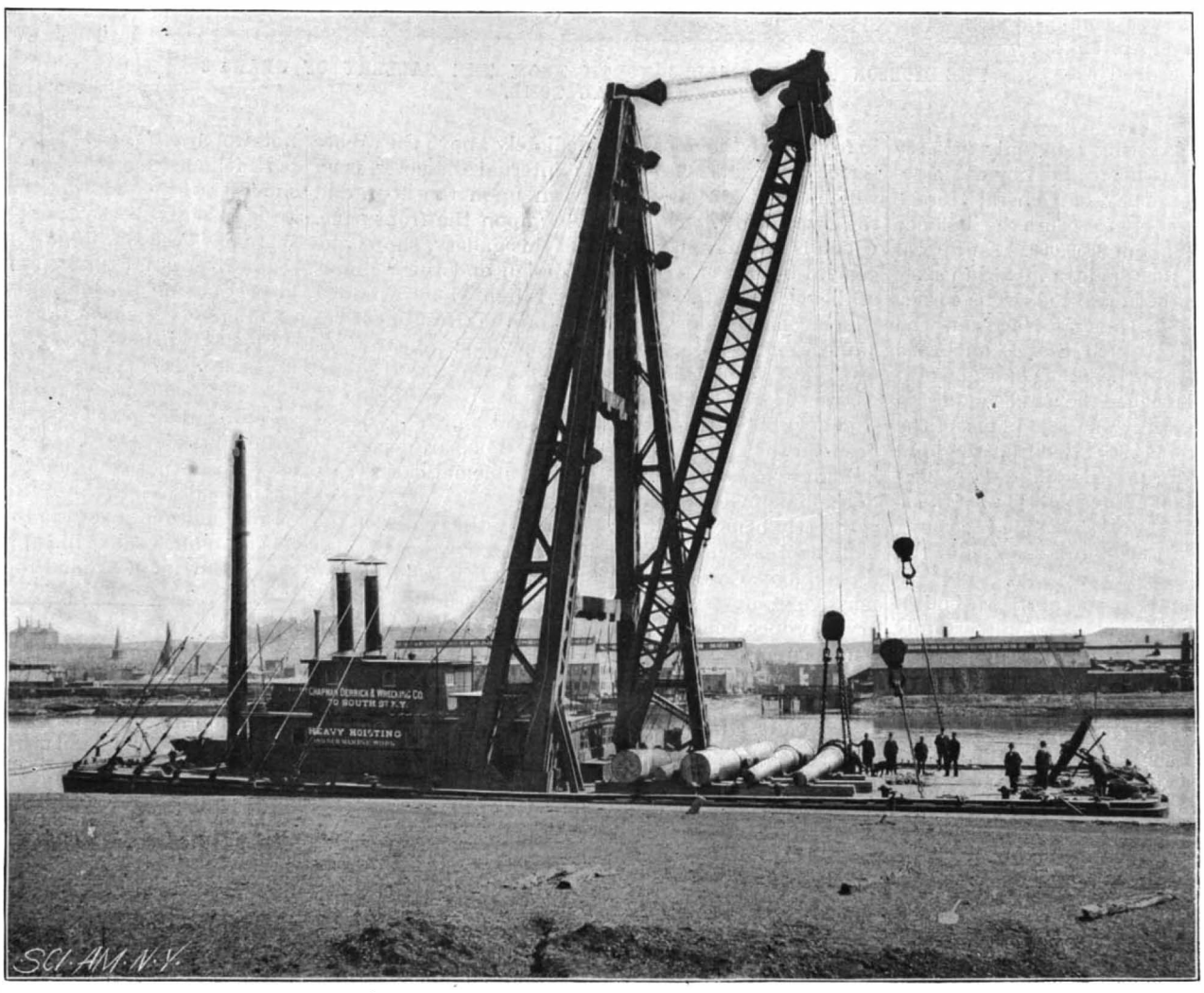
This is claimed by Australia, says the Popular Science News. It was built in California, and some idea of its size may be gathered from the fact that it utilizes 75 horse power, an unheard of amount for this new form of vehicle. This particular car will travel between Coolgardie and the coast, and is intended merely for goods. It will pull over rough roads two other wagons. Coolgardie is 400 miles in the interior, and up to the present time all supplies for the men at the diggings have been transported by the old wagon system, a wearisome task. It was considered impracticable and too expensive to construct a railway to Coolgardie, so the idea of a big motor car was hit upon. As water is scarce on the road to Coolgardie, the steam is not exhausted into the air, but saved, reconverted into water, and again used.

HEAVY SHIPMENT OF ARMY CANNON.

Probably the largest shipment of heavy sea coast, breech-loading, steel rifled cannon ever made at one time and place was successfully accomplished a few days since at the Watervliet Arsenal, near Troy, and the guns, forty-six in number, are now lying at the government proving ground, at Sandy Hook, awaiting their proof test of five full service rounds each before mounting in fortifications.

The contract for the transportation of the guns was awarded to the Chapman Derrick and Wrecking Company, of New York, and the opening of navigation on the Hudson was marked by the arrival at Troy of the enormous floating derrick Monarch. Arrangements had already been made for the prompt delivery of the guns at the arsenal dock by means of a short line of railroad extending from the shops and a steel platform car especially built for the handling of the heaviest guns. The breech mechanisms were detached from the guns and separately boxed, and the highly finished interiors of the guns were protected at breech and muzzle by wooden tompions and lagging.

As soon as the large barges provided by the contractors had arrived at the dock, they were carefully inspected by the officers of the post, and, the report being satisfactory,



HEAVY SHIPMENT OF ARMY CANNON.

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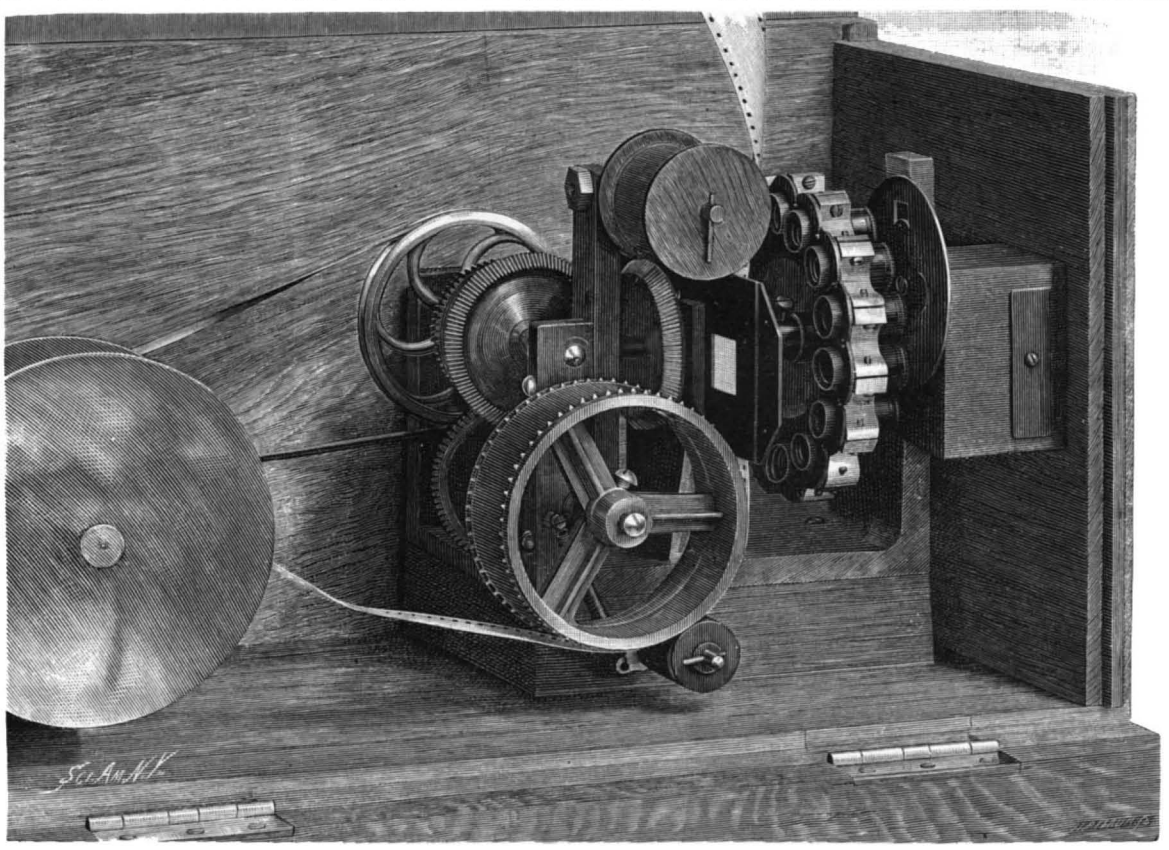


RIBBON PHOTOGRAPHY—A NEW CAMERA.

the loading of the guns was begun. The car was run into the center of the main gun shop, a building 160 feet wide and nearly 1,000 feet long. A gun was then picked up by one of the large traveling cranes, gently lowered into a cradle prepared for it, and the loaded car run rapidly down to the dock. Here the gun was seized by the monster derrick and swung over the deck of the barge, upon which it was lowered and securely blocked, while the car returned to the shop for another gun. As fast as one barge was loaded it was towed aside and another took its place. When all the barges had been thus loaded there were still left five 12 inch rifles, which were placed upon the deck of the derrick itself. The boom of this derrick is a steel built beam 90 feet long and weighs 70 tons, so that as it swung clear across the barge and over the dock, and lifted a gun weighing 116,000 pounds, the list of the float was considerable, but this occasioned no trouble or uneasiness to the experienced handlers.

This shipment comprised forty-six guns, as follows: Fifteen 8 inch rifles of 32,480 pounds each, nineteen 10 inch rifles of 67,200 pounds each, and twelve 12 inch rifles of 116,480 pounds each. The total weight of these guns is considerably over 3,000,000 pounds, and their total value or actual cost is about a million and a half dollars.

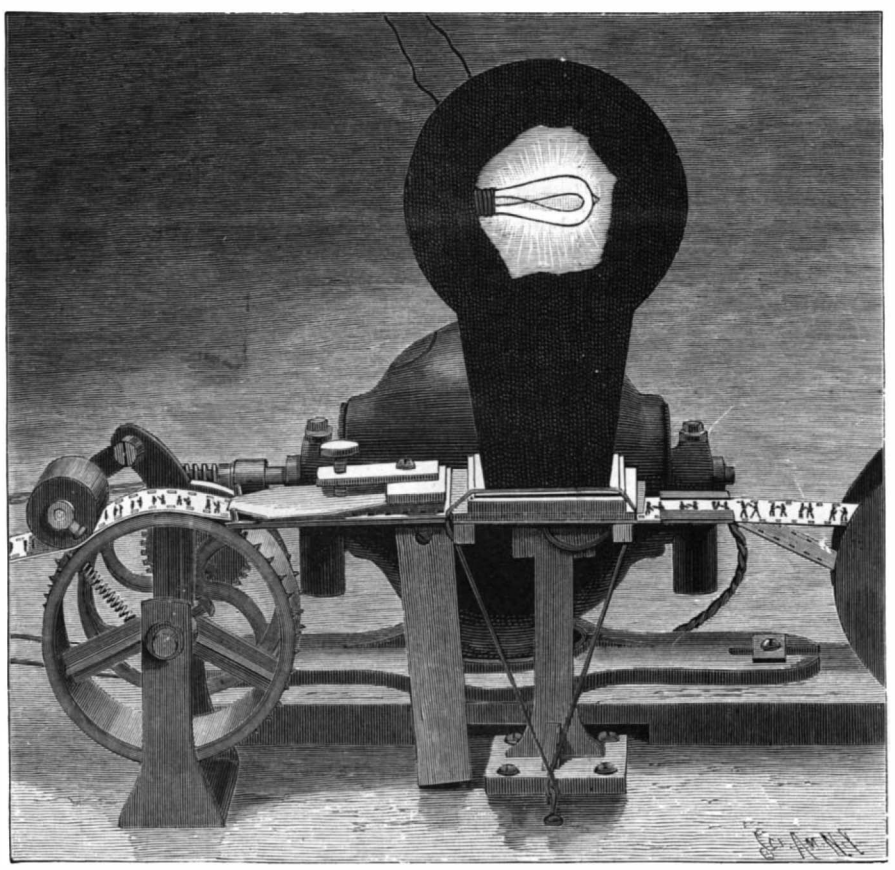
The guns are of steel throughout and of the best American make, which is carefully inspected and tested by the ordnance officers at various stages of manufacture. Each gun consists of a steel tube the full length of the gun (about 36 feet in the case of the 12 inch), over which is fitted a second tube called the jacket, which in turn is enveloped by shorter tubes called hoops. The jacket and each successive layer of hoops are carefully bored to a diameter less than that of the tube and preceding layer of hoops. They are then expanded by heat until they can readily be slipped into their correct position, so that in the process of cooling the various parts of the gun are bound together with enormous power. The exteriors of the guns are then smoothly turned in large lathes and the breech mechanisms, "finished like a watch," are accurately fitted.

The 8 inch rifle fires a steel projectile of 300 pounds with a charge of 125 pounds of powder, giving a penetration in steel armor of 14 inches at 1,000 yards; the 10 inch rifle discharges a steel projectile of 575 pounds with 250 pounds of powder, and gives a penetration in steel of 18 inches; and the 12 inch gun is served with a steel projectile 4 feet long, weighing 1,000 pounds, and with a charge of 500 pounds of powder gives a penetration of 25 inches in solid steel. The extreme range of these projectiles is from ten to twelve miles.

Powerful as are these weapons, they are to be followed shortly by immensely more powerful ones, and preparations are now in progress at the arsenal for the manufacture of a 16 inch breech-loading rifle of 125 tons, which will be served with a charge of 1,000 pounds of powder and a steel projectile of 2,300 pounds, giving a calculated penetration in solid steel of 32 inches at 1,000 yards. It is not believed that any vessel can be built which will successfully resist the terrible impact of such a projectile hurled against it with a velocity of nearly 2,000 feet per second.

Simple Lawn Ornamentation.

The early flowering crocus, with its brilliant blossoms, and the lovely daffodils, beautiful as they are everywhere, are never more attractive than when seen among the grass along a wood border, or judiciously scattered in irregular locations about a lawn. It is better that they should not be seen in every direction as one looks over a lawn, giving an idea of monotonous planting, but in groups or stretches with intervals or reaches of grass between. Thus scattered they furnish individual flowers for our gratification and make a charming picture in the distance. Some varieties of these flowers will grow persistently and increase from year to year, while almost any of them will bloom for a season or two. They like well-drained meadows which are covered with snow most of the winter. They ripen before the grass is fit for mowing, working trifling harm to the hay crop and yielding a harvest of beauty that is exquisitely satisfying.



RIBBON PHOTOGRAPHY—EXPOSING AND PRINTING APPARATUS.

A NOVEL CHRONOPHOTOGRAPHIC CAMERA.

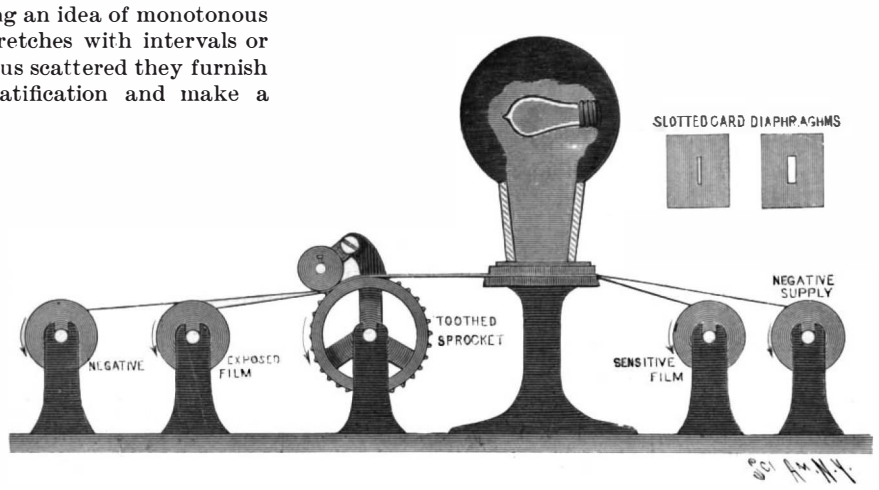
Since the introduction of ribbon photography, by means of which successive pictures are rapidly made of moving objects upon a long ribbon or strip of sensitized film, various devices have been invented, some complicated and others very simple, for the production of the pictures and the manipulation of the picture ribbon.

In the large engraving is illustrated quite a novel camera, the invention of G. Francis Jenkins, for making accurately the continuous series of pictures. Instead of using a rotary disk shutter with radial apertures and a fixed lens, this camera has a single opening in the front, the size of the aperture being regulated at its rear end by a diaphragm disk having radial slots cut therein of varying widths. The operator is thereby enabled to govern the amount of light admitted to the lenses according to the subject to be photographed and the length of exposure desired. This disk is rotated by hand on its axis like an ordinary stop in a wide angle lens.

Back of the diaphragm disk is observed the battery of lenses, each of the same focus, arranged in a circle, adjoining each other upon a rotating disk, the axis of which extends rearward, terminating in a bevel gear wheel, which meshes into a side bevel gear wheel, fixed upon the upper shaft, suitably geared to the main driving shaft. The main shaft may be operated by a crank on the outside of the box, by hand or by any suitable motor like a spring. The sensitized celluloid perforated ribbon film will be noticed passing downward near the front end of the camera in front of the exposure tension plate, the square aperture in which is exactly in line with the front aperture in the box. From this point the film, after exposure, passes downward between the sprocket wheel and pressure roller to the winding reel in the rear end of the camera, which is rotated by belt connection to a pulley on the upper shaft, and takes up the film ribbon as rapidly as it is exposed. The feed roll for the supply of fresh film is not shown, but may be located in the rear of the camera over the winding reel.

The operation may now be readily understood; to obtain successive pictures of a particular object, the camera is placed on a stand or tripod, the crank on the outside is then rotated, which causes the film to travel downward continuously, with exactly the same speed that the lenses rotate, so that at every fraction of a second that it takes for each lens to pass behind the camera aperture, an impression of light is made on the downwardly moving film, and as they (the lenses and film) both move in unison, it follows that a sharp picture must be the result, while the brilliancy of the illumination is at its maximum. The camera can be carried about as readily as any other camera, and in practice it is found the motion of the hand-operated crank is sufficiently uniform to permit of the proper reproduction of motion by the positive pictures when projected on the screen.

The other illustrations show the method of printing the positive ribbon pictures from the negative by means of artificial light, also designed by Mr. Jenkins. It consists of reels supported on suitable upright standards holding respectively the sensitive ribbon film and the negative film. The film from the negative supply reel is carried along over the sensitive film reel and both pass in contact, in continuous motion, under an exposing chamber illuminated by white light, either incandescent electric light or a Welsbach gas light, thence over the toothed sprocket driving wheel to the winding reels, the exposed film being wound first. It will be noticed that the reels are interchangeable, hence to make duplicate



RIBBON PHOTOGRAPHY—DIAGRAM OF THE PRINTING DEVICE.

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copies it is only necessary to remove the negative spool from the winding up end to the supply spool standard of the apparatus and begin over again. The perforations in the edges of the film are of specially square shape and give the square sprocket teeth of the propelling pulley a better pull on the film. The teeth pass through the perforations of both films, causing both to move exactly the same and at all times to keep in perfect register. The speed of the film passing under the exposing chamber must be uniform, and this is obtained by propelling the sprocket wheel by an electric motor or by a spring motor. The electric motor is seen behind the light chamber in the larger of the two engravings. The axle of the motor has worm gear operating a cog wheel on the main shaft. The V shaped elastic band holds the frame (in which is a ground glass) in contact with the films, producing a sort of tension on the film. To the left of the light chamber is a supplementary tension, adjusted by screw nuts, as shown.

Referring to the diagram illustration will be seen two slotted diaphragm cards. These are placed over the ground glass just mentioned, at the bottom of the light chamber, and are for the purpose of regulating the amount of light that acts on the negative. If the negative film, as a whole, should be thin, then the card with the narrow slot is used, which allows a shorter exposure to be made, as the negative and film are passed under it. If the negative is full of density, then the narrow card is removed and the wider slotted card substituted, which allows a larger volume of light to act upon the negative film. The exposed film is wound around large open reels from its spool, and developed by passing through troughs of developer solutions.

The necessity of providing apparatus to quickly reproduce positive impressions from the negative ribbon films is one of the reasons why this simple device was invented, and its novelty consists in the fact that the film moves continuously under a uniform source of light without any intermittent motion or the use of shutters. The operation of exposing the film is carried on in a room illuminated by the usual ruby red light.

National Academy of Sciences.

WASHINGTON MEETING.

BY WILLIAM H. HALE.

The meeting of the National Academy of Sciences, held at the Smithsonian Institution, April 20–22, was attended by over thirty members, or about one-third of the entire membership; the president, Prof. Wolcott Gibbs, in the chair.

The business transacted included the election of Asaph Hall as vice-president, in place of F. A. Walker, deceased; of Ira Remsen as home secretary, in place of Prof. Hall, promoted; and of Alexander Graham Bell as treasurer, in place of Dr. Billings, resigned. Additional members of the council elected were: H. P. Bowditch, G. J. Brush, J. S. Billings, O. C. Marsh, Simon Newcomb and Arnold Hague.

New members elected are: William H. Dall, of Washington; Frank A. Gooch, of New Haven; Charles S. Minot, of Boston; and Edward W. Morley, of Cleveland.

Only fourteen papers were read, and five of that number were obituaries, viz., of G. Brown Goode, by S. P. Langley; of Thomas L. Casey, by H. P. Abbot; of Charles E. Brown-Sequard, by H. P. Bowditch (read by title); of Hubert A. Newton, by J. W. Gibbs, read in his absence by A. W. Wright; and of George H. Cook, by G. K. Gilbert.

The scientific papers were "The Influence of Environment upon the Biological Processes of the Various Members of the Colon Group of Bacilli," an experimental study by Adelaide Ward Peckham, M.D. (presented by J. S. Billings); "On the Energy Involved in Recent Earthquakes," by T. C. Mendenhall; "On a Ring Pendulum for Absolute Determinations of Gravity," by T. C. Mendenhall and A. S. Kimball; "On the Variation of Latitude," by S. C. Chandler; "Variation of Latitude and Constant of Aberration from Observations at Columbia University," by J. K. Rees, H. Jacoby and H. S. Davis (presented by S. C. Chandler); "The Position of the Tarsiids and Relationship to the Phylogeny of Man," by Theodore Gill; "A New Harmonic Analyzer," by A. A. Michelson and S. W. Stratton; "On Recent Borings in Coral Reefs," by Alexander Agassiz; "Notes of Experiments upon the Roentgen Rays," by A. W. Wright.

In the last named paper, Prof. Wright gave results of his experiments which seem to confirm the theory that these rays are not refrangible. By using flat plates of glass instead of prisms, he obviated the effect of the thicker part of the prism on the rays, which, by absorbing them, gives the appearance of a negative index of refraction. Beside the plate of glass he placed a crystal of Iceland spar, without obtaining evidence either of refraction or of polarization. In another series of experiments he employed means to obtain a thin ray and to pass it between the poles of a powerful magnet, and afterward reversed the poles, but without inducing any perceptible change in the direction of the ray. The most interesting point in his experiments has been made within a few days and is not yet fully verified; but in using a screen of platinum wires he observed that the screen caused a faint dark line to appear, which may correspond to the interference lines in the spectrum. If so, this would indicate that these rays can be diffracted, even if they are not capable of refraction.

The next meeting of the Academy will be held at Boston, on November 16 next.

SLOW SPEED CABLE CAR GRIP FOR USE ON CURVES.

The cable car system of traction is at a great disadvantage wherever it is necessary to put in any sharp curves on the line of the road. The construction of the ordinary form of cable car grip is such that, if a stop is made in the middle of a curve, and the cable is released, it will leave the grip and spring toward the center of the curve. Hence, in order to traverse a curve, the gripman takes a firm hold on the cable and swings around on to the next tangent at full speed. That there is danger in such a practice goes without saying, and on such a line as the Broadway cable road, New York, the risk becomes unbearable. The most troublesome curve on this road is one which leads at Fourteenth Street from Broadway into Union Square. Fourteenth Street is one of the busiest thoroughfares in the city, and its proximity to the shopping district causes a large part of the pedestrian traffic to consist of women and children, who are continuously passing across the double tracks of the Broadway cable line at a point near the center of the curve. When it is borne in mind that the cars run under ten seconds' headway in the busiest hours of the day, the danger to pedestrians at this point can be realized.

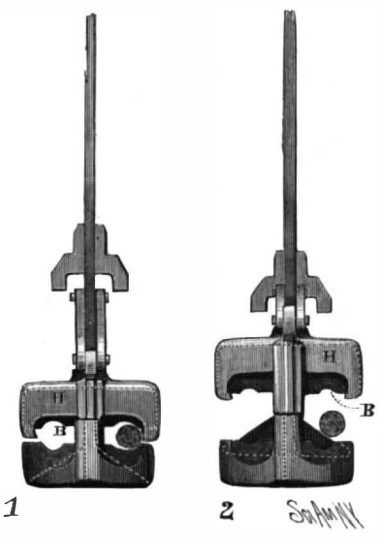

FIG. 1.—Cable released but held in place by hooks.

FIG. 2.—"Tripping" the cable.

Various plans have been proposed by which to meet the difficulty, all of which were more or less objectionable, for the reason that they involved either the appropriation or disfigurement of a part of Union Square grounds. It was proposed to carry the tracks directly across the square at street level or beneath it by means of a tunnel. Another suggestion involved cutting off the corner of the block at Fourteenth Street and Broadway, or carrying the tracks through the block by means of an arcade cut bodily out of the buildings. It will be seen that all of these plans aimed at one thing—the elimination of the sharp curve at Fourteenth Street—and that they all took it for granted that the mechanical difficulties connected with the grip and cable were unsurmountable.

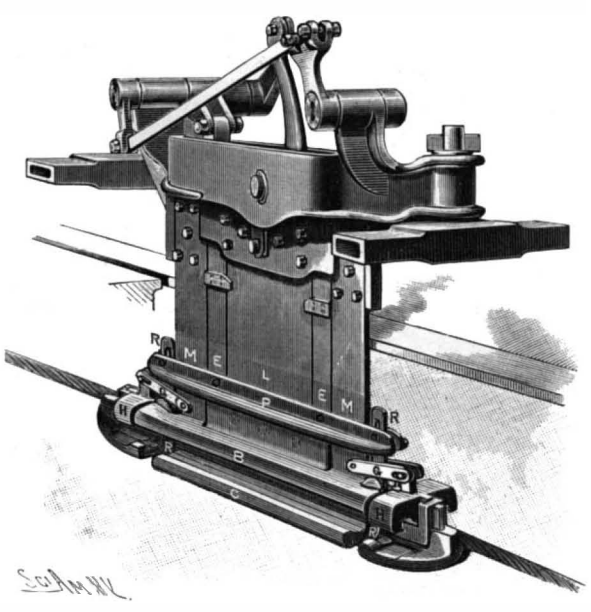

Fig. 3.—PERSPECTIVE VIEW OF GRIP WITH RETAINING HOOKS ATTACHED.

The solution of the difficulty, however, has come in the shape of a very simple mechanical contrivance, which is so easily applied and operated as to cause surprise that it was never thought of when the cable grip was first designed. By reference to the engravings it will be seen to consist of nothing more than a couple of loose hooks, H H, which keep the cable in the grip when the upper jaw, B, is raised to release the cable.

The grip consists of a lower fixed jaw, C, and an upper movable jaw, B. The lower jaw is rigidly attached to a crosshead on the track frame by means of two vertical shanks of plate steel, M M, and is always carried at a fixed level. The upper jaw, B, is carried by a shank, L, which is raised or depressed by the action of levers attached to the crosshead and operated by the gripman. The jaws are each provided with two longitudinal grooves, so that the cable may be taken up on either side of the grip. When the car is stationary the cable runs in the groove in the lower jaw, and the car is started by depressing the upper jaw and gripping the cable, the speed of the car being regulated by the pressure of the grip. At full speed the cable is held perfectly stationary in the grip, and at slower speeds it is allowed to slip somewhat, the car being carried along by the friction between the jaws and the cable.

The cable is thrown out of the grip altogether, or "tripped," by raising a couple of wedges (shown in Fig. 2), which are carried by links, R, bracket, P, and the two plates, E E, and are operated by a separate lever on the car. The plates, E E, are provided with stops which, as the plates are lifted, engage the shank, L, and raise the top jaw, B, to the position shown in Fig. 2.

The trouble with the old form of grip was that when B was raised on a curve the cable would spring out to the inside of the curve and be "lost." To remedy this the hooks, H H, whose cross section conforms to that of the jaw, B, are hung by links, G, to the jaw near its ends, and have a slightly larger vertical movement than the jaw. When the latter is raised sufficiently to release the cable, the hooks, H, remain down in place and keep the cable from springing sideways out of the grooves. This position is shown in Fig. 1. If B be raised still further, as in "tripping" the cable, a swelling upon the jaw just below the link, G, serves to raise the link and carry the hook clear of the cable.

It will thus be seen that this very simple device enables the speed and stopping and starting of the car to be controlled with as much certainty on a sharp curve as on a tangent, and we are informed by Chief Engineer Pearson that the thirty cars which have already been equipped with it are giving the greatest satisfaction.

Artificial Fuel.

Eggette or ovoid fuel, in distinction from briquettes, says the English journal Machinery, may be considered somewhat of a luxury for domestic use, similar to that which anthracite coal bears to bituminous. In Europe, the convenience of the fuel for the furnace was not so much considered as the ability to produce a fuel which was cheapest and best suited for handling, storage, and transportation. Much greater stress than in America was laid on the thorough preparation of the coal, on the quality of the pitch or binding material used, and on the size of the blocks giving the greatest economy in manufacture and handling.

The systems of preparing the coal for coking and briquetting, by washing and jigging, originated in Europe and have there been long practiced to such an extent that almost throughout the whole of the Continent coke can be guaranteed to contain only a certain per cent of ash. This difference in the art of washing fine coals may to some extent account for the slow progress made in the manufacture of briquettes in America.

Statistics show that the production of briquettes in 1893 was as follows:

France	1,750,000	tons.
Belgium	1,200,000	"
England	850,000	"
Austria	250,000	"
Germany	1,230,000	"
Italy	560,000	"
Spain	100,000	"
Russia and Sweden	100,000	"
United States	100,000	"
China, India, and Canada	150,000	"

The proper mechanical preparation of the coal goes far toward making the briquetting of an otherwise waste of coal successful and profitable. That the thorough washing or freeing from all slate and other impurities is one of the chief factors in determining the value of the product is obvious, since the value of the fuel depends mainly on its freedom from ash, or the amount of available combustible matter it contains. This is especially important where the fuel is to be transported and an extra cost is added for handling and transportation.

The Pneumatic Mortar Carriage.

Recent tests of the pneumatic mortar carriage, of which we gave an illustrated description in our issue of January 2, have demonstrated its ability to be fired through an abnormally large arc of elevation. Owing to the fact that the recoil cylinders are at all times in line with the bore of the gun, it can be fired from 2° depression to 75° elevation—a distinct advantage over the common form of hydraulic carriage, which is provided with a fixed recoil cylinder placed at a certain angle, and has a limited range between 48° and 65° of elevation. The construction of the pneumatic carriage allows the gun to be mounted nearer to the surface of the ground than is usual, and its manipulation is rendered proportionately easy.

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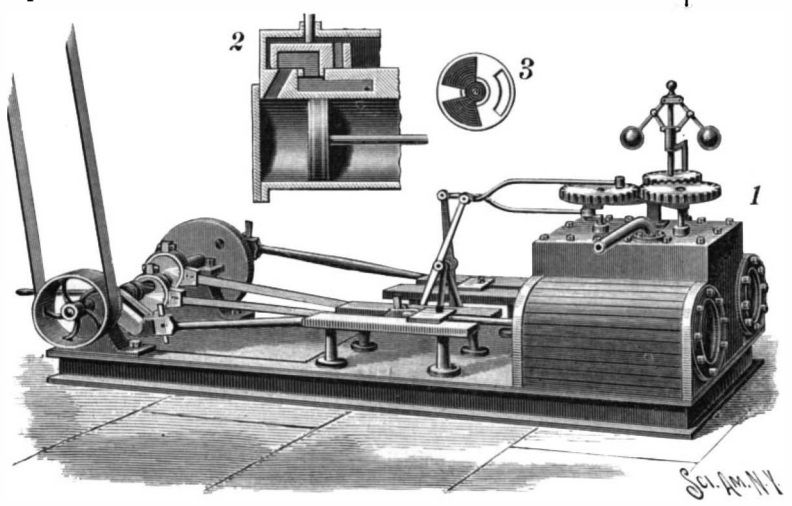
AN IMPROVED STEAM ENGINE.

The accompanying illustration represents a durable, simple, and comparatively inexpensive engine, in which two cylinders are arranged side by side and have their piston rods connected to a common crank shaft. The improvement has been patented (letters patent No. 571,034), and is being introduced by Col. H. S. Blanchard, of Helena, Mont. The engine has no dead center, and its rotary valves are arranged to so cut off and cut in the steam that a volume of one full port will always be exerted on a piston, and when the crank is on the quarter, giving the greatest leverage, there being no pressure exerted and energy lost when a crank is on the center. Fig. 2 is a detail sectional view of one of the steam valves and connections, showing means for a quick exhaust, and Fig. 3 is an inverted plan view of the valve. The cranks are placed at an angle of ninety degrees to each other, and one is preferably arranged directly on the shaft while the other is on the fly wheel, the steam chest being midway of the cylinders. In the bottom of the steam chest is a base plate which serves as a seat for the rotary valves, which revolve above groups of ports in each end of the steam chest, the ports being arranged in pairs and connected with channels or leads which deliver into the end portions of the cylinders, there being also ports connected with channels which lead to the exhaust pipe. The valves have each a constant and steady motion in one direction, although moving opposite to each other, but by means of a forked shifting lever the engine may be easily and instantly reversed. Each cylinder begins to take steam when the crank arm is at an angle of about forty-five degrees off dead center, but one cylinder being in power at a time, and remaining in power while the crank arm is passing through an arc of about ninety degrees, when steam is shut off from the first cylinder and admitted to the other cylinder, each cylinder using the steam expansively in finishing its stroke. The same power continuously applied by the cylinders alternately to the same leverage, i. e., top and bottom quarters of the wheel, results in a uniform turning movement through the entire revolution and is designed to afford a gain in leverage of thirty-seven per cent besides the gain by not being in power on the dead centers, which actual tests are said to show to be as much more. The steam supply is very nicely and automatically regulated by the governor, which is substantially like the ordinary ball governor, but it is applied to the controlling valve in a different way. Its swinging arms are connected by short arms with a sliding sleeve on the governor shaft, this sleeve being secured to an angle lever pivotally connected by a link with a crank on a shaft at one side of the steam chest, and having arms connected with the slide valves. In case anything breaks, the steam is entirely shut off, thus stopping the engine.



BLANCHARD'S DUPLEX STEAM ENGINE.

The Antiquity of the Steel Square.

The author of "The Steel Square and Its Uses" speaks of the antiquity of that useful tool as follows:

"Pliny says that Theodorus, a Greek of Samos, invented the square and level, but this cannot be, for the square figures in the represented designs of the Tower of Babel, one of the earliest known structures. The city of Babylon was a perfect square, and the bricks used in its buildings and walls were square; so probably were those in Babel. Now, to form squares correctly, and to introduce them in endless combination into buildings, it needed a guiding instrument of some kind. So the square, as a constructive tool, came into use. Among the ruins of Babylon, Nineveh, and Petra it is said to have been found represented. There are pictures and sculptures from the ruins of Thebes in Egypt showing the square in the hands of the artisan. Evidences of its use are also to be seen in ruins in India, which are thought by some to antedate those found in Egypt. Among the ruins of the Aztecs, or the people before them, in Peru and Brazil, it has also been found; and though tools of stone and flint, such as axes, hatchets, hammers, etc., were the first used by primitive man in these ruins that date back beyond history, the square is found, and specimens may be seen in the British Museum. The square was regarded by the ancients as a symbol of completeness. Simonides speaks of a man square as to his hands, feet, and his mind, etc. Aristotle uses a similar expression." It now transpires that the square was known and used by the ancient Babylonians, as far back as 9,000 years before Christ, if we are to place any confidence in the recent discoveries made at Nippur by Americans who are making excavations at that ancient city.

Protective Spectacles for Workmen.

Injury to the eyes by dust, sparks, flying splinters, and stones is by no means rare, and only imperfectly prevented by the ordinary spectacles. These are made either of wire gauze, and are then so dark that the men cannot help taking them off occasionally, or of glass. The latter are not liked, says Stone. A cold draught makes them dim, and the grimy hands are not suited for cleaning them. They are destroyed by heavy blows, moreover, and themselves give dangerous splinters, and the side frames have to be pressed close against the cheeks, so that ventilation is stopped, and the men complain about hot eyes. Dr. Thomalla, of one of the Berlin accident wards, has devised a spectacle made of Schering's gelatoid, an elastic perfectly transparent material, which can be hardened in amyl-acetate. If really broken by flying pieces, the mass does not splinter. Ventilation is effected through oblique perforations, through which under exceptionally unlucky circumstances only a splinter or dust particle might find its way. The gelatoid does not condense moisture on its surface, and does not become so hot as glass near an open fire. It does not catch fire.

RECENTLY PATENTED INVENTIONS.

Mechanical.

PREVENTING END MOTION IN SHAFTS, ETC.—Joseph Himes, Port Blakely, Washington. To prevent longitudinal movement in either direction of shafting and spindles, this invention provides that a journal portion of the shaft or spindle shall have a swelled portion in the form of two integral cone frustums, and that to these shall be applied, at the bearings, coniform sleeves, in pairs, slidably connected by a tongue and groove, permitting their longitudinal adjustment, but preventing the rotative movement of either sleeve. The device may be applied in connection with a supporting step block for a vertical shaft, or in an end or other bearing for a horizontal shaft. Two patents have been granted the inventor on this invention, one relating more particularly to a bearing for continuous horizontal shafts.

PUMP.—Elmo G. Harris, Rolla, Mo. This pump is arranged to be economically worked by compressed air, and is more especially designed for raising water in mines or delivering water in a water delivery system. The pump has two closed pumping chambers with bottom pipe connections for admitting and discharging water and top connections for admitting and discharging air, a shifting valve or switch forming a part of the connections from the inlet and discharge pipes of the air compressors to the pumping chambers, there being also an operating mechanism for the shifting valve.

CLEANING TEXTILE FIBERS. — Louis Drach, Buhl, Germany. From the cops, or from the reel carrying the yarn, the threads pass through thread guides and over a rod to the cleaning device, as provided by this invention, which comprises adjustable jaws with teeth in a zigzag path for the thread, mounted on a pivoted support connected with a lever whose free end is connected with the thread guide board, whereby, when the board is raised and lowered to distribute the coils of thread upon the bobbin, the cleaning device is also raised and lowered by the lever, and the angle of inclination of the threads and their tension is maintained.

HAMMOCK MAKING MACHINE.—Ignacio Basulto, New York City. This machine comprises a series of needles or bars around which the thread is wound by suitable movable guides, there being mechanism for advancing the meshes thus formed, and means for feeding the material forward. A fabric of practically unlimited length may be made, there being used as many mesh-feeding bars as the complete fabric has rows of meshes, and various patterns may be produced by using cylinders with cam grooves of different shapes.

Agricultural.

ONION TOPPER.—Arba E. Vrooman, Arthur, North Dakota, and Warren F. Vrooman, Madison, Ohio. To quickly remove the tops from vegetables without bruising or injuring them, these inventors have devised a simple and inexpensive machine, to be run either by power or by hand, the various parts being readily adjustable for large and small vegetables. Supported over topping rollers is a trough having an opening registering with the space between the rollers, fingers extending along one side of the trough, and there being a connection between the roller driving device and the finger carrying bar. The rollers engage the tops to pull them from the vegetables, the latter being discharged in good condition, while the tops and clinging dirt and dust accumulate beneath the machine.

CORN HUSKER.—Marcus W. Bailey, Woodhull, Ill. A husking glove provided by this inventor has a finger cap, a finger band, a hinged connection between the sides of the band and the finger cap and a flexible connection between their fronts, there being also a point on the top edge of the finger cap and a rigid thumb ferrule with a flange extending above its upper surface. Ample provision is made for ventilation in the glove, by means of which the corn may be husked cleanly and quickly, without unduly tiring the operator.

STUMP PULLER.—Edgar Nelson, St. Mary's, Ohio. A simple and forceful means for applying power is described in this invention, applicable for pulling stumps and other purposes, the device being a part of the anchor or connecting means, by which the strain may be released when desired, and the slack partially taken up before commencing the pull. The tension draught device has an interposed slack member consisting of a long link with S-shaped bar connecting its opposite sides, while a retaining device attached to the tension draught device is adapted to hold the ends of the slack member.

Miscellaneous.

BICYCLE BRAKE.—Albert N. Godfrey, Port Townsend, Washington. Journaled in a hanger pivotally connected by a link with the front frame fork is a pulley with slightly concave rim covered with vulcanized rubber, to bear on the bicycle tire, the ends of the pulley being coniform and being journaled in vertical slots in concave-shaped shoes on the inside of the hanger. Extending up from the hanger is a pusher bar connected with a brake-actuating lever whose free end extends near the handle bar at one side. A spring holds the brake pulley normally away from the wheel, but by a slight movement of the brake lever the brake pulley is moved downward, inducing frictional resistance between its coniform ends and the inside shoes of the hanger at the same time that a graduated resistance takes place between the pulley and the wheel of the bicycle.

RUDDER FOR BOATS.—Levi M. Thomas, Punta Gorda, Fla. The rudder stock, according to this invention, is connected by a brace with the upper portion of the rudder blade, and the lower portion of the latter is pivotally connected with the boat by a socketed plate on the skeg, and a plate on the rudder carrying a pin. Attached to the rear of the boat is a bearing for the rudder stock, consisting of a hinged clamp with adjustable locking device. With this construction the rudder may be readily shipped and unshipped and the device is strong and simple.

SEWING MACHINE ROLLER BEARINGS.—William S. Sutton, Belvidere, Ill. The bearings provided by this invention each consist of a cup movably held in a frame, a cone on a revoluble post projecting into the cup, a set of balls in the cup engaging the cone, and a threaded sleeve surrounding the revoluble post and screwing in the frame with its inner end engaging the cup to adjust the latter. Any wear may thus be readily taken up, and the friction of the moving parts is reduced to a minimum.

VALVE MECHANISM.—James A. Healy, Nashville, Tenn. For flushing devices, hydrants, etc., a valve mechanism is provided by this inventor that may be easily reached for repairs, hich will be self-closing, and in which leakage is reduced to a minimum. In a discharge tank having a waste outlet is a water receiving and discharging pipe with valve seat and valve in its lower end, a valve casing in the pipe having a valve and a waste outlet, and there being a connection between this valve and the first valve. A stem extends upward from the waste outlet valve, a push rod having a cup-shaped lower end into which the stem extends, while a valve pipe surrounds the rod and a plug valve on the rod engages in a valve seat in the valve pipe.

FENCE.—James W. Hammett, Eureka, West Virginia. In wire fences this invention provides a peculiar construction and arrangement of a brace panel and a hillside post, to increase the strength and stiffness of the fence and adapt it to firmly stand on a hillside, and also to be easily repaired, should it be weakened by caving or washing of the bank. The post has a slotted and wedge-shaped metal foot, and an angular surface bracket, with one end attached to the post and the other end slotted to receive anchorage pins, while a diagonal brace extend from the surface bracket to the post.

NECK YOKE.—John W. Harper, Higgins, Neb. The top of the outer end of the pole, according to this invention, has a roughened surface or an attached cogged plate, on which a curved cam plate with a cog surface is pivotally held by means of a loop extending beneath the pole, a crossbar at the upper ends of the loop forming a pivot for the cam. Straps or rods extending through the center of the pole, and held in position by nuts, connect with the pole loop, and hold the cam in binding contact with the cogged plate on the pole, so that, whether the draft be forward or back, any slipping of the yoke is prevented.

FOLDING BED.—Israel A. Dodge, Fort Worth, Texas. A bed which can be cheaply made, and may be easily moved from place to place, is provided by this invention. the bed body having sliding handles and a hinged frame turning down to secure the bedding. Pivoted to the body are base legs which form a stop, and pivoted outer legs are connected by links with the base legs. When turned edgewise the bed takes up but small space for storage or shipment, and is light and easily handled and perfectly safe, requiring no dangerous weights or springs.

FOLDING BED.—George S. Hastings, Long Island City, N. Y., and William W. Flagler, New York City. A multiple folding bed or structure has been devised by these inventors, in which a number of beds may be folded to be out of the way, and with their backs against each other when not in use, in like manner to berths upon a vessel. The beds are pivoted at their rear ends in a frame, within which the beds fold one back of the other, the legs being pivotally connected with the uppermost bed near its outer side, while a supporting bar connects the legs and receives the outer portion of the lower bed. A weight is attached to the legs to assist in holding the beds in folded position. Beds in the nature of bunks may be quickly and inexpensively erected according to the construction provided for by this invention.

BATH TUB.—John C. Lacy, Long View, Texas. A small portable or foot tub is, according to this invention, provided with a removable shield and seat capable of enlarging the size of the tub and of furnishing a rest for the person using it. The shield is crescent shaped and bent so that its lower edge may lie snugly against the upper edge of the tub, the upper edge of the shield extending outward and upward from the tub. The shield also has a seat and a pocket on each side is held in place by means of side clips, while pivoted to its back are folding wire rod legs.

PRESERVE JAR GRAPPLE.—Henry Gartelman, New York City. To facilitate the handling of jars while filling them with preserves, etc., this inventor provides a device comprising two pivoted arms with bands of steel or other flexible material secured to the arms on opposite sides of the pivot, the bands being adapted to engage the peripheral surface of the jar. On the outer end of one of the arms is a foot to engage the bottom of the jar as it is clasped by the tool. The diameter of the bands may be readily increased for jars of different sizes, and, with this implement, jars and their contents may be heated and then handled, and the cover fastened in place, without soiling or scalding the hands.

SAFETY RAZOR STROP.—Albert L. Silberstein, New York City. This strop has a spring-pressed casing fitted to slide on the strop bed, a blade holder journaled on the casing having a shaft carrying at its ends gear wheels, racks sliding on the sides of the casing being in mesh with the gear wheels. The operator, by simply moving the racks forward and backward, causes an automatic sliding of the cutting edge of the razor blade over the holder, and also an automatic reversing of the strop at the end of each stroke.

ASH SIFTER.—Charles A. Morse and George F. Shattuck, New York City. In a suitably constructed casing adapted to receive in its upper end the material to be sifted is a peak shaped screen, there being under the screen a hopper and a chute discharging into the ash pan. Coal and cinders rolling down the sides of the peak shaped screen are directed by deflectors upon other screens and carried in a zigzag course to a coal box, any ashes being separated and carried to the ash pan. The work of separating the ashes from the coal and cinders is thus automatically performed.

GARMENT PIN.—Jennie McK. Secord, Rotterdam Junction, N. Y. This inventor has devised a fastening pin for hats and bonnets, or which may be used as a shawl pin, or with other articles of apparel. It has a ringlike head, around cross bands of which are passed an elastic cord, forming separate runs of the cord, which also carries a block in which is a recess to receive the point of the pin. After pushing the pin through the article the pin point keeper is placed over the point by stretching the cord.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(7156) J. W. C. asks: 1. Is it necessary to amalgamate the zincs of a Crowfoot gravity battery? A. It is not necessary and is not usually done. 2. How can the sulphate of copper solution be kept down? I am very careful in starting a cell, filling up with clean water and dropping in crystals of sulphate of copper, but the solution does not settle, and in a few hours, even without current, the zinc becomes coated with the mud of the copper—and with a current is much worse, the coating getting very thick and hanging down like icicles. A. Using the battery for work is supposed to keep the copper solution down. Apparently you do not use a sufficient excess of copper sulphate. Certainly, with an excess of crystals and by occasional renewing of the upper layers of the liquid, the taking of a current from the battery should tend to obviate, not produce, the difficulty. If you let the battery run too long, the increase in specific gravity of the zinc sulphate solution will bring about the difficulty complained of. 3. Method of calculating the gear of a bicycle. A. Divide number of teeth on front sprocket wheel by number on rear sprocket wheel and multiply the diameter of the driving wheel thereby.

(7157) W. R. T. writes: I have the use of 64 gravity cells 6×8 for fifteen hours each day. 1. Can I fully charge three chloride accumulators, type "D," consisting of 5 plates, size 6×6 inches, in that time? A. You will probably not get over one-tenth of a charge out of the gravity batteries running for the period of time which you mention. 2. How should the gravity cells be connected? A. A good arrangement would be 16 in series and 4 in parallel. 3. How many 3 candle power lamps, 6 volts and under, can be run from these three storage batteries at one time? A. Twelve to eighteen at good incandescence. 4. Would it injure the storage batteries to leave them connected in circuit while the gravity cells are in use on a Morse circuit? A. It would not injure the batteries. It would, of course, exhaust them proportionately to the service and might give too strong a current for the apparatus.

NEW BOOKS, ETC.

PROBLEMS AND QUESTIONS IN PHYSICS. By Charles P. Matthews, M.E., and John Shearer. New York: The Macmillan Company. London: Macmillan & Company, Ltd. 1897. Pp. vii, 243. Price $1.60.

Modern physics has received a new momentum from the application to it of the theory of dimensions. While this has given it a new meaning, it does not do to make a merely mathematical science of so subjective a branch as physics. The subjective treatment of physics by the older school has done much to retard the proper advancement of the science. In the present work the author starts with the theory of dimensions and elucidates most excellently the starting point of physics. The work in the book is largely comprised of problems, and it seems a very admirable production. Yet from a somewhat hasty examination of it we are inclined to think that the author would have done better had he been more expansive in his introductory portion. Thus it seems to be assumed that the person using the book will understand thoroughly what force, energy and work are, but we certainly would like to have seen these subjects more fully treated. Perhaps it is simply because the work has impressed us so favorably that we make this criticism, because we think that an adequate treatment of the subjects of force, work and energy would have been most acceptable from so eminent an author.

MECHANICS OF VENTILATION. By George W. Rafter. Revised Second Edition. New York: D. Van Nostrand Company. 1896. Pp. 143. Price 50 cents.

In this little book, which by the appearance of its second edition indicates its popularity, we find a well known member of the familiar green colored Van Nostrand Science Series. Its reaching a second edition goes to show its utility. Without going into abstruse mathematics, it gives full systems for use for testing and calculating ventilation apparatus of different descriptions.

TABLES FOR THE DETERMINATION OF MINERALS BY PHYSICAL PROPERTIES. Ascertainable with the aid of a few field instruments. Based on the system of Prof. Dr. Albin Welsbach. By Persifor Frazer. Fourth edition, to which one hundred and thirty-five additional species have been added. Philadelphia: J. B. Lippincott Company. 1897. Pp. xi, 163. Price $1.50.

The accomplished mineralogist, in 99 cases out of 100, determines minerals by their appearances pure and simple. We have before reviewed a similar book from an American source. In the present work the author makes a less exacting differentiation. The divisions are three, based on luster and streak: The first, metallic luster, is arranged in five subdivisions, based on color; two divisions of metallic and non-metallic luster include six divisions for colored streaks. Three divisions, all of non-metallic luster and white or light gray streaks, are divided by their sectility and hardness. Beyond this each mineral has to be individually determined. The usual methods are applied for determination. A supplement of nearly fifty pages which is appended simply gives minerals in alphabetical order, abandoning all attempt at classification.

The Garden and Forest, a weekly publication conducted by Charles S. Sargent, Professor of Aboriculture in Harvard College, is a paper which every one desirous of being well informed in matters relating to horticulture, landscape art and forestry should take. The bound volume covering the numbers for the year 1896 constitutes a handsome quarto of 530 pages, embellished with many beautiful and original illustrations, and the reading matter treats of a wide variety of subjects, and is all of high quality.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

APRIL 20, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Account keeping apparatus, M. H. Roberts ... 580,899
Addressing machine, F. D. Rettich ... 581,010
Aerating liquids, apparatus for, P. C. Hewitt ... 581,206
Air ship, H. Heintz ... 580,941
Amalgamating and concentrating precious metals, apparatus for, H. H. Eames ... 581,106
Amalgamator, J. A. Hedge ... 581,159
Animal shipping box, G. Bell ... 581,191
Animal trap, G. U. Hall ... 580,861
Annealing furnace, rotary, W. S. Vosburgh ... 580,997
Armature for dynamo electric machines, A. L. Parcelle ... 580,889
Armature for dynamos and electric motors, sectional, G. L. Jeck ... 580,977
Audiphone, compound, J. A. Lakin ... 580,872
Automatic clamp for textile machinery, H. W. Butterworth ... 581,102
Axle, car, J. H. Egbert ... 580,934
Baking pan, H. Hollandt ... 581,232
Bale tie, L. Barceloux ... 580,841
Basket for fruit, vegetables, or other commodities, W. C. Mallett ... 580,947
Batteries, construction of, E. N. Dickerson ... 581,104
Bearing, C. A. Svensson ... 580,994
Bearing for vehicle wheels, ball, C. E. Roberts ... 580,956
Bed bottom, spring, C. R. Barker ... 581,097
Beer manufacturing apparatus, P. C. Hewitt ... 581,207
Beer, packing, cooling, and dispensing device for, J. Ruppert ... 581,085
Belt holder, L. W. Rice ... 581,140
Bicycle handle bar, A. V. Green ... 581,254
Bicycle handle bar, adjustable, A. V. Green ... 581,255
Bicycle sprocket mechanism, L. B. Gaylor ... 581,024
Binder, L. M. Leslie ... 581,123
Binder, loose sheet, L. M. Leslie ... 581,124
Bleaching by electrolysis, apparatus for, A. E. Woolf ... 581,052
Boiler cleaning apparatus, Burneson & Richey ... 581,247
Boiler rooms and furnaces, introducing air into, N. W. Pratt ... 580,895
Boiler tube plug, M. J. Hughes ... 581,209
Bolt machine, J. Wagner ... 581,144
Bookcase, Brown & Merrill ... 580,844
Book holder, E. Glover ... 581,225
Book or pad, sales, Webber & Bingner ... 580,914
Bottle, J. J. Allen ... 580,968
Bottle, J. H. Poole ... 581,134
Bottle and bottle stopper, S. S. Miller ... 580,878
Bottle making machine, Reeves & Maurader ... 581,083
Bottle, non-refillable, Doty & Donnellan ... 581,150
Bottle, non-refillable, W. S. Hannaford ... 581,157
Bottle stopper, J. A. Donahue ... 581,105
Bottle stopper, E. N. Gilfillan ... 581,153
Box. See Animal shipping box. Fare box. Knockdown box. Metallic box.
Box, H. L. R. Wolf ... 581,051
Boxes of cardboard, etc., machine for applying strips of paper or cloth to, B. Romer ... 580,958
Braiding machine, J. H. Jones ... 580,944
Brake system, fluid pressure, W. T. Bothwell ... 580,843
Brick press, hydraulic, J. J. Koch ... 581,223
Buckle, back band, J. S. Brown ... 581,193
Building block and column, composition, J. Schumacher ... 581,142
Burial casket, W. Hamilton ... 581,155
Burner. See Gas burner.
Bushing for block sheaves, roller, W. W. Andrews ... 580,999
Butter worker, E. P. Smith ... 581,043
Button cap, C. H. Goodwin ... 581,111
Cabinet, document, J. J. Shtuchka ... 581,241
Calculating machine, D. J. T. Hiett ... 580,863
Can heading machine, A. Calleson ... 581,018
Can opener, K. L. Westerfield ... 580,916
Car coupling, D. R. Joslyn ... 581,072
Car coupling, J. M. McMillan ... 580,887
Car coupling, J. Meyer ... 581,125
Car door bracket, E. A. Hill ... 580,943
Car draught gear, Brauer & Kelso ... 581,192
Car fender, Carhart & Aldrich ... 581,059
Car fender, A. Di Trani ... 580,932
Car sand box, railway, F. S. Bliss ... 581,016
Car seat, F. H. Henry ... 580,976
Cars, unloading attachment for railway flat, S. W. Hall ... 580,974
Card, self supporting, E. T. Gibson ... 580,858
Carpet stretcher, U. T. Mengert ... 581,167
Carriage, folding baby, Server & Javitz ... 581,013
Case. See Bookcase.
Cash register, pocket, G. O. Brager ... 581,057
Caster, W. Merl ... 581,216
Centrifugal machine, P. C. Hewitt ... 581,205, 581,208
Chain, velocipede, H. M. J. Jacquet ... 581,071
Christmas tree candle holder, A. W. Hoffmann ... 581,249
Churn, Ray & Vickers ... 580,898
Churn and butter worker, M. F. Stadtmuller ... 581,182
Churn and butter worker, combined, Penn & Guild ... 581,133
Cigar marking and cutting device, E. A. Marti ... 581,029
Cigarette machine, C. R. Martin ... 581,077
Cinnamic aldehyde, obtaining, F. Ach ... 581,053
Cistern refill, J. W. Hale ... 580,860
Clamp. See Automatic clamp. Clothes clamp. Rug clamp.
Cleaner. See Flue cleaner.
Clip. See Paper clip.
Cloth cutting machine, E. M. Waring ... 581,092
Cloth cutting tool, C. W. Cohn ... 580,969
Clothes clamp, F. J. French ... 581,152
Clothes line adjuster, R. R. Quackenbush ... 580,896
Clothes line conveyer, A. G. Molteni ... 581,169
Clothes line reel, T. J. Pearson ... 581,009
Coal burning furnace, J. Eynon ... 581,108
Comb, P. Schulz ... 581,040
Computing and measuring machine, cloth, O. Heckel ... 580,862
Cooler. See Milk cooler.
Copied effects to letters, machine for damping and giving press, A. J. Bodkin ... 581,056
Copying apparatus, W. Junge ... 581,163
Corn cutter and binder, J. A. Stone ... 580,908
Cotton gin, T. J. Griffin ... 581,069
Cotton hook, P. J. Murphy ... 580,949
Coupling. See Car coupling. Hose coupling. Pipe coupling.
Crate, bicycle shipping, W. C. Fear ... 581,151
Crusher. See Rock or ore crusher.
Curling iron, E. D. Middlekauff ... 580,877
Cutout, automatic, C. A. Rolfe ... 580,957
Cutter. See Potato cutter. Stone cutter.
Cutter head, S. J. Shimer ... 581,178
Cutting, folding, and winding strips of flexible material, machine for, Adams & Hawes ... 581,015
Cutting machine safety device, J. C. Leslie ... 580,874
Cyanide solutions, treating, J. C. Montgomerie ... 580,948
Cycle brake, E. A. Hine ... 581,005
Cycle, sky, C. E. Myers ... 581,218
Die holder and box, R. Turner ... 581,143
Disinfecting and deodorizing, method of and apparatus for, A. E. Woolf ... 580,919
Display rack, W. J. Unkenholz ... 581,049
Diving apparatus, C. Paul ... 581,174
Door opening device, Peck & Taft ... 581,132
Drier. See Fiber drier.
Dusting device, R. L. Farchild ... 581,109
Easel for pictures, etc., J. Berbecker ... 581,098
Electric cables, erecting aerial, F. S. Viele ... 581,242
Electric machine, dynamo, M. O. Southworth ... 581,089
Electric wire conduits, junction box coupling for, J. P. Coghlin ... 581,064
Electrical resistance coil, J. Nebel ... 581,170
Elevator, C. A. Harkness ... 581,114, 581,115
Elevator, C. R. Pratt ... 580,893
Elevator safety device, C. R. Pratt ... 580,894
Engine. See Rotary engine.
Envelop, F. M. Criswell ... 581,019
Envelop, H. E. Dyer ... 581,003
Envelop fastener, safety, J. W. Wilkins ... 581,220
Envelop, safety, H. A. Lange ... 580,873
Fare box, O. Katzenberger ... 581,164
Fastening device, W. B. Draper ... 581,224
Feed cutting machine, W. J. Clark ... 581,062
Feed water heating apparatus, Jones & Wilson ... 581,212
Feeder, poultry, O. F. Johnson ... 581,120
Feeding, cutting, and printing machine, F. Meisel ... 580,985
Fence, L. Clark ... 580,847
Fence, wire, G. H. Chandlee ... 581,195
Fence, wire, J. M. Keith ... 580,869
Fence, wire, H. Watkins ... 581,145
Fiber drier and cleaner, C. C. Wolcott ... 581,096
Fire alarm system, C. E. Buell ... 580,927
Firearm, J. M. Browning ... 580,923 to 580,926
Firearm, C. J. Ehbets ... 580,935
Fire escape, W. W. Cook ... 581,197
Fire escape, Edgington & Calhoon ... 580,852
Fire escape, H. Steimann ... 580,961
Fireproof wall and partition for buildings, T. Bailey ... 581,227
Fish and fish offal, apparatus for treating, J. C. W. Stanley ... 581,045
Fish plates, device for, J. S. P. Strickler ... 580,903
Fishing appliance, H. J. Welch ... 580,915
Flood gate, H. Lorton ... 580,876
Flood gate, W. O. Phillips ... 580,892
Flue cleaner, fluid pressure, G. D. Harris ... 581,231
Folding machines, device for removing offsets from, J. L. Firm ... 580,938
Fruit jar, K. E. Gunkle ... 581,112
Furnace. See Annealing furnace. Coal burning furnace. Muffle furnace.
Furnace, F. Robbin ... 581,084
Furnace, S. G. Smith ... 581,179
Furnace grate, W. W. Churchill ... 581,061
Furnaces, apparatus for feeding comminuted fuel to, Allen & Tibbitts ... 581,244
Furnaces, peep hole for cupola, G. F. Speer ... 581,014
Furniture, combination article of, M. Joo ... 581,233
Gas burner, E. G. Golder ... 581,025
Gas burner, T. Holliday ... 581,117
Gas manufacturing apparatus, A. M. Hay ... 581,203
Gases and liquids, apparatus for mixing, J. J. Flanders ... 581,022
Gate. See Flood gate. Swinging gate.
Glass blowing machine, N. W. Hartman ... 581,158
Glass tube grinding machine, T. W. Van Hoesen ... 580,913
Grain scourer, Keith & Lanphere ... 580,978
Hammer, T. W. Mackie ... 580,946
Hanger. See Sign hanger.
Harvester, thrasher, and separator, combined, J. S. McCormick ... 581,219
Hat dipping machine, C. S. Peck ... 580,891
Hay rake, horse, W. J. Cook ... 581,001
Heater. See Hot water heater.
Heel attaching machine, Raymond & Fogg ... 581,039
Heels, machine for making wooden, L. H. Dwelley ... 580,933
Hinge, blind, P. O. Myer ... 580,885
Hitching post, P. H. Conner ... 581,065
Hog ringing trap, Runnells & Pratt ... 581,175
Hoisting drum, S. H. Pitkin ... 580,952
Holdback, vehicle, C. H. Mills ... 580,879
Hook. See Cotton hook. Mail pouch hook. Snap hook.
Horse boot, pneumatic, R. Sites ... 581,042
Horse training device, J. S. Weathers ... 580,965
Hose coupling, A. G. Kinyon ... 580,871
Hot water heater, T. S. Bayles ... 581,190
Huller. See Pea huller.
Hydrant, M. P. Elgen ... 580,936
Ice shave, Schwenk & Wilson ... 581,177
Indicator. See Lamp indicator.
Inkstand, G. C. Marlitt ... 580,981
Ink well, L. G. Houser ... 580,864
Insole, G. W. Young ... 581,146
Insulator, electric wire, J. E. Sharpe ... 581,088
Insulator for electric railways, section, S. L. Foster ... 581,023
Interrupter, D. M. Moore ... 580,988
Interrupter, oscillating, D. M. Moore ... 580,987
Iron. See Curling iron. Smoothing iron.
Iron shears, T. W. Schulze ... 581,176
Jack. See Lifting jack.
Jar. See Fruit jar.
Jar holder, M. E. Arnould ... 581,054
Kiln floor, dumping, W. H. Prinz ... 581,137
Knitting machine, C. J. Appleton ... 581,253
Knitting machine, J. Schmitt ... 580,902
Knockdown box, W. E. Keeler ... 581,234
Knot tying device, A. J. Nichols ... 581,240
Label, tree, F. Blake ... 581,221
Ladder, store, P. A. Myers ... 581,239
Lamp, acetylene gas generating, W. H. Dennis ... 581,020
Lamp, electric arc, W. L. Preece ... 581,136
Lamp for liquid hydrocarbons, incandescent, K. Trobach ... 581,090
Lamp for railway carriages, petroleum, Erber & Dietrich ... 580,970
Lamp indicator, J. W. Morgan ... 581,007
Lantern, E. Ferriss ... 581,200
Lantern, cycle, F. Rhind ... 581,139
Lap board and table, combined, M. H. McCorkle ... 581,127
Lasting shoes, attachment for, W. H. Usher ... 580,911
Lawn sprinkler, W. Quayle ... 581,252
Leather staking machine, A. V. Hysore ... 580,865
Lifter. See Pan lifter.
Lifting jack, M. H. Tyler ... 581,048
Lifting jack, Goodwin & Brown ... 581,154
Liquid deliverer, check controlled, H. D. Colman ... 581,149
Lock. See Permutation lock.
Lock, W. H. Ball ... 580,921
Lock, J. C. Hollman ... 581,161
Lock hub, W. H. Taylor ... 580,963
Loom, carpet, Kynett & Tuttle ... 581,075
Magnet, G. G. Brown ... 581,101
Mail bag fastening, E. H. Ort ... 580,888
Mail pouch hook, G. A. Whitehead ... 580,917
Malting machine, M. A. Barber ... 580,840
Match safe, L. L. Kellogg ... 580,870
Measurer, milk, A. C. Jacobi ... 580,866
Medical apparatus, electro, R. H. Wappler ... 581,091
Metal bending machine, C. T. Draper ... 581,002
Metal, machine for cutting, shearing, punching, and embossing, P. Middaugh ... 580,986
Metallic box, G. H. Williamson ... 581,189
Milk cooler, J. F. Harvey ... 581,070
Milk tester, G. G. Wickson ... 581,188
Mill. See Roller mill.
Mill and scale, combined, F. W. Gibson ... 581,068
Moulding fence posts and making cores for same, W. P. Cahill ... 580,928
Moulding radiator sections, mould for, O. Bryant ... 581,017
Mop head, adjustable, P. J. Scharbach ... 580,959
Mop wringer, D. N. & H. L. Hyre ... 581,222
Motor. See Spring motor.
Mower, M. Kane ... 580,868
Muffle furnace, revolving, A. R. Meyer ... 581,168
Music leaf turner, C. E. Shuler ... 581,041
Music leaf turner, L. H. Payne ... 581,081
Musical instrument damping device, mechanical, F. A. Richter ... 580,955
Nipples and stud bolts, machine for making, W. C. & F. E. Wells ... 581,187
Nose clamping device, L. Ray ... 580,954
Nut lock, J. A. Lombas ... 581,215
Oar lock, A. Baylies ... 580,842
Oar lock, ball bearing, J. V. Lewellen ... 581,214
Ore washer, C. F. Pike ... 581,033
Oven, Chambers & Seymour ... 581,060
Oven, reel, J. R. McWilliam ... 581,128
Packing, metallic, E. L. Raynsford ... 581,138
Pail and lantern, dinner, Bryan & Harriman ... 581,058
Pail, oyster, J. W. Knight ... 581,028
Pan. See Baking pan.
Pan lifter, C. S. Rose ... 580,900
Paper box machine, J. M. Hitchcock ... 581,116
Paper clip, H. D. Reeve ... 580,991
Paper, elevator for feeding sheets of, C. H. Heywood ... 580,942
Paper holder, T. P. Mautz ... 581,237, 581,238
Parcel delivery system, G. E. Pancoast ... 581,131
Pattern marking apparatus, L. Schaefer ... 580,901
Pea huller, C. A. Ketcham ... 581,073
Pedal rubber attachment, F. J. Willard ... 581,095
Pegging machine, Davey & Ladd ... 581,066
Pen for recording instruments, fountain, F. A. Jones ... 581,121
Pen guide, D. Nevin ... 581,171
Pen, shading, F. Van Gerpen ... 580,939
Perforating machine, check, B. F. Mills ... 581,126
Permutation lock, O. J. Jonsson ... 581,226
Photographic pictures on porcelain, producing, J. F. Fritsch ... 581,004
Pipe. See Tobacco pipe.
Pipe, apparatus for manufacturing angular, P. Boyd ... 581,228
Pipe coupling, G. F. Wentz ... 581,050
Pipe joint repairer, W. Vanderman ... 580,996
Pipe threading and cutting machine, W. C. Wells ... 581,186
Placer dirt, apparatus for treating, C. F. Pike ... 581,035, 581,037
Plow, M. C. Cone ... 581,000
Post. See Hitching post.
Potato cutter, L. Sternberg ... 580,962
Power. See Wave power.
Power of sea waves, apparatus for utilizing, B. M. Fletcher ... 581,067
Power transmitting mechanism, U. Root ... 581,012
Precious metals, apparatus for treating placer dirt in recovering, C. F. Pike ... 581,036
Precious metals from magnetic ores, apparatus for separating, C. F. Pike ... 581,032, 581,034
Press. See Brick press.
Print mounting roller, J. F. Marsters ... 580,982
Printers' quoins, supplemental tightener for, A. T. H. Brower ... 580,922
Printing machine inking apparatus, W. Scott ... 580,963
Printing machine vibrator roll, F. Meisel ... 580,984
Printing on fabrics, machine for, Haddon & Kuenemann ... 581,201
Printing on fabrics, machinery for, Haddon & Kuenemann ... 581,202
Projectile, E. M. Johnson ... 581,211
Propeller, boat, L. Sands ... 581,086
Propeller wheels, etc., device for reversing motion of, G. E. Tregurtha ... 581,184
Pulley, reversible, R. S. Paxton ... 580,890
Pulverizing ores, etc., machine for, Storer et al. ... 580,909
Pump, electric, B. Heftye ... 581,204
Pump, force, C. S. Currie ... 580,848
Puzzle, W. H. Backus ... 580,839
Radiator, steam or hot water, W. A. Seevers ... 580,904
Rail joints, method of and means for forming, H. W. Falk ... 580,971
Railway buffer arrester, J. A. Weber ... 581,185
Railway frog, J. W. Meads ... 580,983
Railway rail fastening, W. J. Morrison ... 581,217
Railway switch, G. M. Hilbert, Jr. ... 581,026
Railway switch, Egge & Schaffer ... 581,229
Railway tie, metallic, H. Erickson ... 580,937
Railway track instrument, C. H. Sherwood ... 580,906
Rake. See hay rake.
Reel. See clothes line reel.
Reflector, chandelier, N. Weeks ... 581,094
Reflector for art galleries, show windows, etc., N. Weeks ... 581,093
Register. See cash register.
Riveting and pressing machine, C. B. Albree ... 581,147
Rock or ore crusher, Hanna & Gates ... 581,113
Roentgen rays, apparatus for utilizing, C. F. Easton ... 581,199
Roller. See print mounting roller.
Roller mill, centrifugal, Propfe & Zarniko ... 581,082
Rolling sheet metal, apparatus for, F. Menne ... 581,078
Rotary engine, T. R. Almond ... 580,838
Rubber tubing, method of and apparatus for manufacturing seamless, J. J. Fields, Jr. ... 580,854
Rug clamp, S. P. Hanson ... 580,975
Rule, folding, G. R. Willcox ... 580,918
Sad iron pad, S. C. Woodhead ... 581,243
Sand bin and appliances, W. G. Root ... 581,141
Sash balance, J. Oefinger ... 581,130
Sash fastener, window, W. S. Gardner ... 580,856
Sash, window, E. B. Spencer ... 580,992
Saw set, J. Bowles ... 581,245
Saw sharpener, L. Littlejohns ... 580,875
Saw tooth, inserted, A. G. McCoy ... 580,950
Sawing machine, Tope & Gartrell ... 581,183
Scale, computing, O. O. Ozias ... 581,172, 581,173
Scissors with cloth cutting attachment, T. Thorlakson ... 580,995
Seeding machine and disk harrow, combined, W. G. Munn ... 581,030
Selling device, electric, Davidson & Armstrong ... 580,931
Sewing and cutting machine, buttonhole, F. W. Ostrom ... 581,031
Sewing machine, W. H. Currier ... 580,849
Sewing machine feed mechanism, J. A. Jones ... 581,162
Sewing machine quilting attachment, J. W. Clayton ... 581,063
Sewing machine, shoe, G. E. Milner ... 580,880
Sewing machine thread controller, D. W. Goodell ... 581,110
Shade, window, G. W. Everett ... 581,230
Shears, presses, etc., mechanism for operating, J. Kennedy ... 581,165
Shears. See iron shears.
Shoe, Jordan & Kelly ... 581,122
Shutter, ventilated, C. H. Pease ... 580,990
Sieve box or shoe, L. C. Holt ... 581,118
Sign apparatus, illuminated, J. H. Richardson ... 581,011
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(*Continued on page 286.*)

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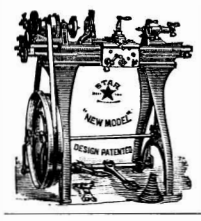

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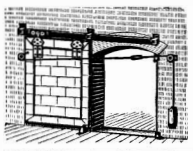

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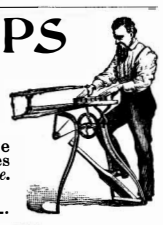

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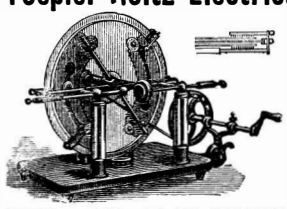

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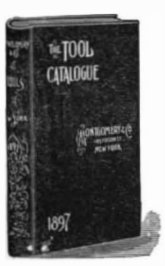

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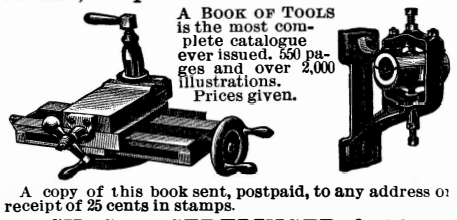

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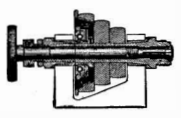

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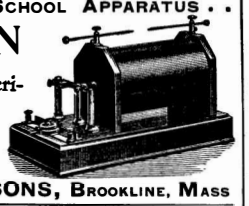

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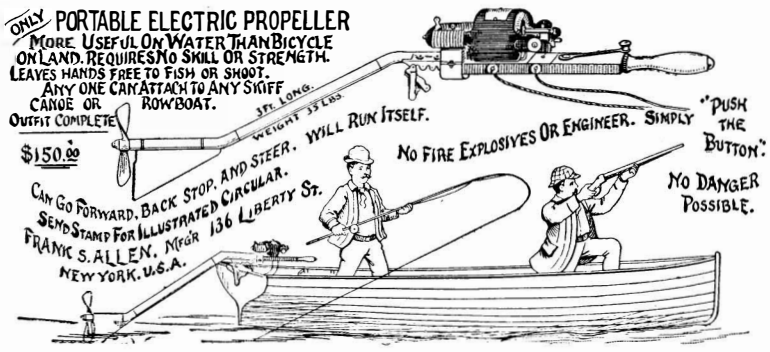
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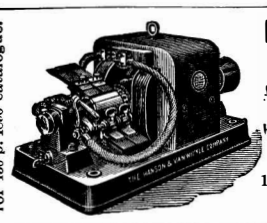

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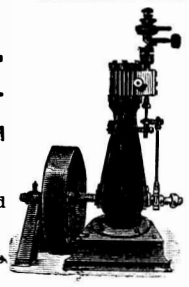

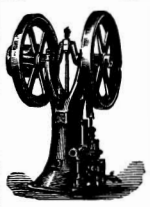

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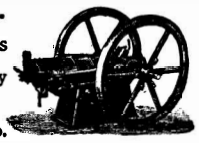

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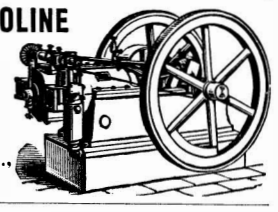

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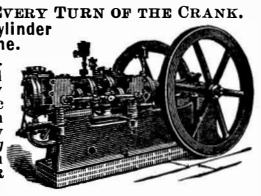

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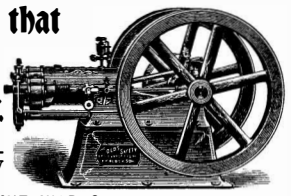

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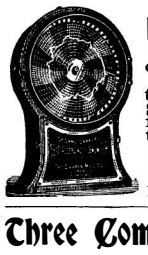

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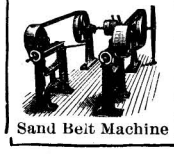

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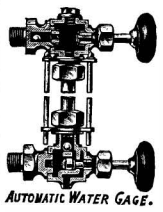

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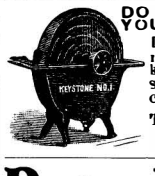

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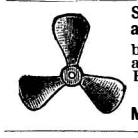

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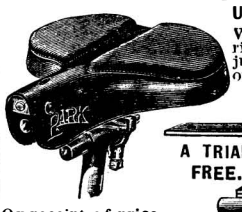

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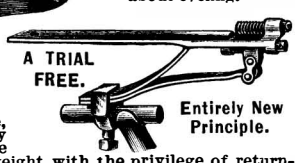

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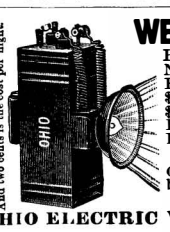

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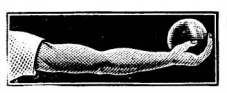

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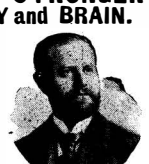

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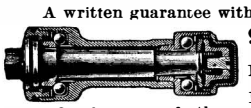

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IT is the only perfect one.
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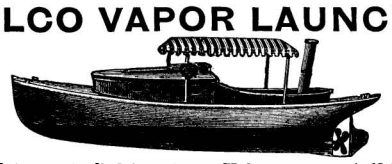

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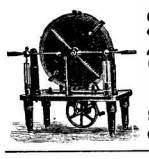

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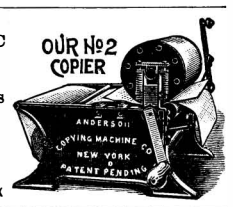

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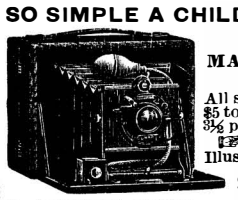

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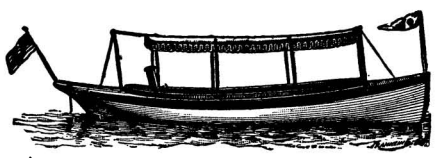

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All riders say it is—THE BEST.

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EVER READY AND RELIABLE

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WE MAKE OUR TUBE
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Because a Tube like this of our **.50% CARBON STEEL** Is just as strong as a Tube like this of **.25% CARBON STEEL**

While WEIGHT FOR WEIGHT in a Bicycle our **FIFTY CARBON Steel** will last so long and **TWENTY-FIVE CARBON Steel** will last only so long . . . . .

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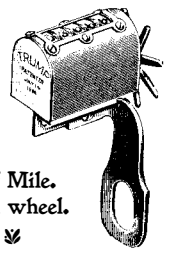

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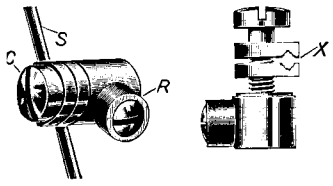

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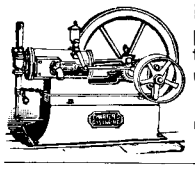

is used for almost every purpose power is applied to under the sun, and is unequaled.

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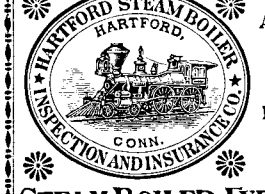

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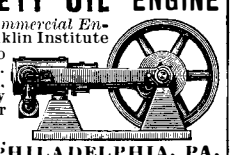

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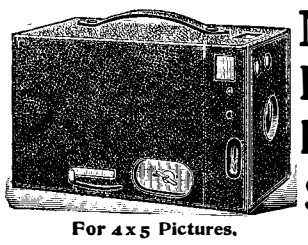

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For sale by all retail jewelers.

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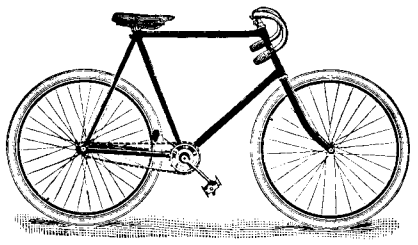

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